THE MODEL ENGINEER

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MODEL POWER BOAT NEWS—THE 1953 GRAND REGATTA

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THE MODEL ENGINEER

EVERY THURSDAY

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Our Cover Picture

At the recent exhibition in the Isle of Wight, Saunders-Roe Ltd. had a most interesting stand, a view of which is the subject of our photograph this week. In connection with the firm's apprenticeship scheme there is an extensive and fully-equipped training school, in which the apprentices are encouraged to develop their skill by making models of all kinds. At the exhibition the stand was fitted up to represent part of a workshop where some of the apprentices could be seen engaged in the construction of a 25-c.c. petrol engine of their own design. In addition, certain examples of completed work were on view; these included a 2½-in. gauge *Fayette* locomotive built to "L.B.S.C.'s" notes, which was running on compressed-air, in the centre of the stand, during the exhibition.

SMOKE RINGS

The "M.E." Cover Competition

THE COMPETITION which was conducted at THE MODEL ENGINEER stand at this year's "M.E." Exhibition was a considerable attraction to visitors. The results were almost exactly what we expected, but they may possibly surprise some of those competitors who have not had so many years of experience as we have had in ascertaining the tastes of our readers! Elsewhere in this issue will be found a list of the prize-winners together with an account of the day-to-day variations in the voting.

Exhibition at Huddersfield

THE HUDDERSFIELD S.M.E. will be holding a model engineering exhibition at the Drill Hall, St. Paul's Street, Huddersfield, from 21st to 24th of October, opening at 10.30 a.m. each day. There will be a very comprehensive competition section which has been planned in two parts, one open to anybody, and the other to members only, every phase of model engineering is to be covered, and there is a generous list of prizes.

Entry forms are available from C. S. Woollard, Engineers Small Tools Ltd., Market Street, Huddersfield, and no entrance fee is to be charged.

Public Privileges

WE CONTINUALLY receive complaints from readers regarding the withdrawal of facilities for running model boats, cars and aircraft in public parks or other places administered by municipal authorities; in many cases these privileges have been enjoyed for so many years that they are taken for granted, and their foreclosure comes as a serious blow. While we have every sympathy with clubs or individuals who ask our advice on the matter, there is little that we can do about it in a positive way. A privilege is essentially something on which one cannot insist, nor take any action if it is withdrawn. But we do think that in many cases the decisions of public bodies in these matters are too precipitate, and often without due consideration of all aspects of the case; the decision to impose a ban on anything to which some objection—possibly frivolous—has been made by a clamorous minority is often the line of least resistance.

Model engineering organisations have not the weight of numbers to press their views, but they have many claims to serious consideration by the authorities. They are often approached to assist in schemes such as exhibitions to promote local charities or civic celebrations, or in "Holidays at Home"—and are seldom, if ever, found wanting. Their function in promoting craftsmanship has a definite connection with industrial prosperity, and should be recognised; the healthy and creative diversions which they offer to the coming generation are even more valuable, and it is not too much to say that if there were more model engineers there would be fewer juvenile delinquents. They have, of course, an obligation to behave as good citizens in all things, and to take all possible care to safeguard the public and avoid noise or other nuisance when running their models; if they are prepared to accept these responsibilities, privileges granted by public bodies will undoubtedly pay good dividends.

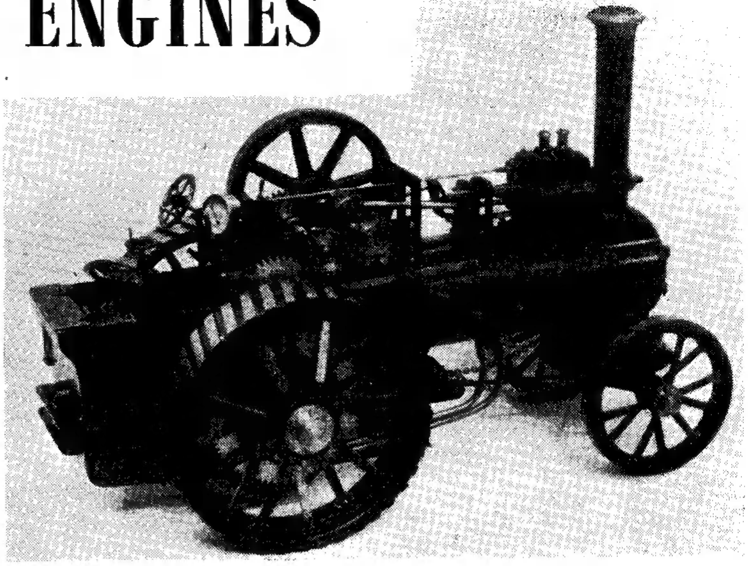
Exhibition at Shrewsbury

THE SHREWSBURY & District Society of Model and Experimental Engineers will be holding its exhibition at the Technical College, Shrewsbury, on Friday and Saturday, November 6th and 7th next. The opening times will be 7.0 to 9.0 p.m. on the Friday and 2.30 to 9.0 p.m. on the Saturday.

As usual, the exhibition is non-competitive, and loan exhibits from any model engineers will be very welcome. Any readers interested are invited to communicate with the Hon. Secretary, MR. W. T. HOWARD, at the Technical College, Shrewsbury.

TRACTION ENGINES at the "M.E." EXHIBITION

By W. J. Hughes



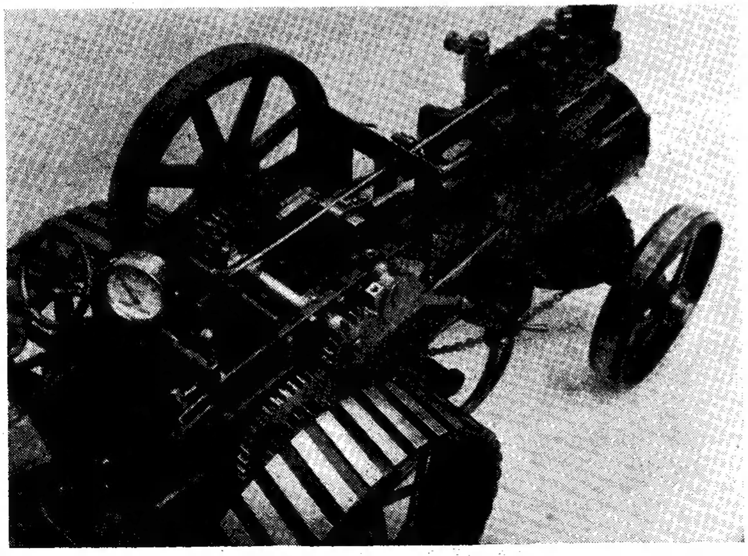
This inch-scale traction-engine was exhibited by J. Wallace, of Stagsden, who was Highly Commended for it.

COMPARED with last year's Exhibition, it must be admitted that the traction-engine section at the 1953 show was disappointing! But we must remember that last year was an exceedingly good year, with several engines of very high quality indeed, and several others of a standard not much lower.

This year there were but two entries in the competition section, and one on loan. J. Wallace, of Stagsden, had entered a 1-in. scale engine, which was awarded a Highly Commended diploma, and W. D. Urwick of Taplow showed a 1½-in. scale engine which was Commended by the judges. The inch-scale job was to the early "M.E." design, and as the award of a diploma will show, the finish and workmanship were good. The flywheel had eight spokes, and a very heavy rim, both of which detracted from the general appearance; to forestall criticism, let me say at once that I am aware that Fowler's fitted an eight-spoked flywheel to some engines, but that the Greenly design is based to some extent on the Davey Paxman, with only six.

Other points noted on this model were the use of cheese-head screws to secure the spud-pan to the front axle, and that the strakes on the hind wheels came to the edges of the rims, instead of being stopped short just inside the edges.

Mr. Urwick's engine also was well made, with a good finish, but here again were some points of criticism, such as a *brass* connecting-rod (with a marine-type big-end), screws used instead of studs and nuts to secure the cylinder-covers, and the spectacle and front plates secured by screws instead of being riveted to the hornplates. Nor were the shaft-bearings very traction-engine like, or the unshrouded gears.



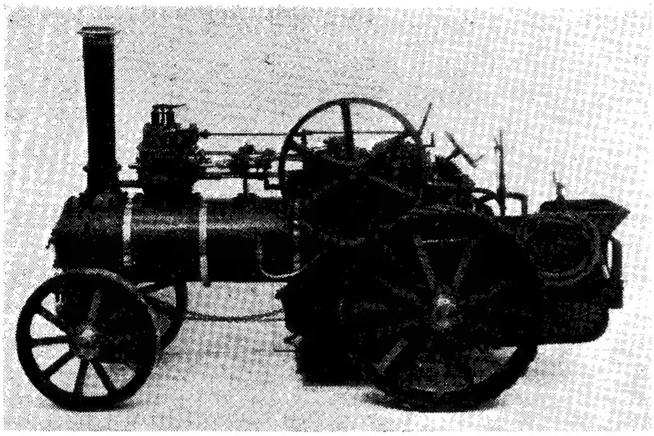
Footplate, gearing, and motion of Mr. Wallace's engine

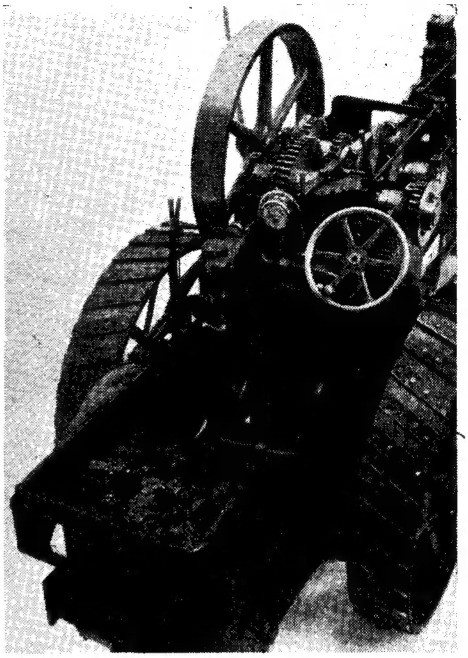
Schoolboys' Effort

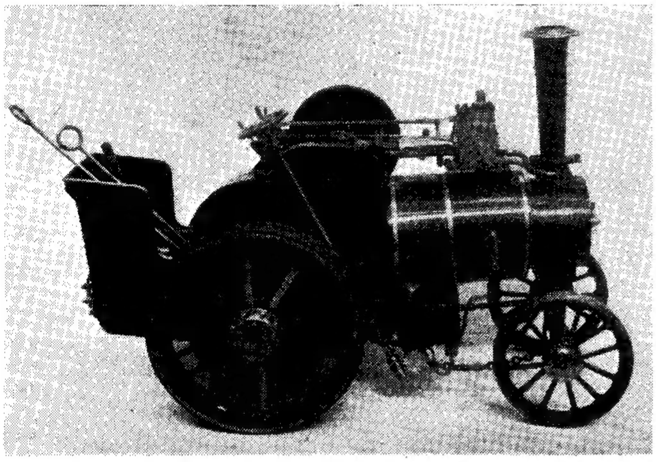
The third exhibit was a traction-engine built by sixteen boys, of varying ability, and all under sixteen years of age, at the Cuckoo Hall Secondary Modern School, Edmonton.

This engine had been specially designed by the metalwork master, J. R. Aimer, for construction by boys, and in these circumstances there were good reasons for several features which did not conform to prototype practice.

The chief criticism, in fact, concerns the general proportions of the engine, but even here there were governing factors. For example, the boiler is too short and too fat, but Mr. Aimer told me that this was because the tube used was "salvage," left on the school site when the builders departed. The



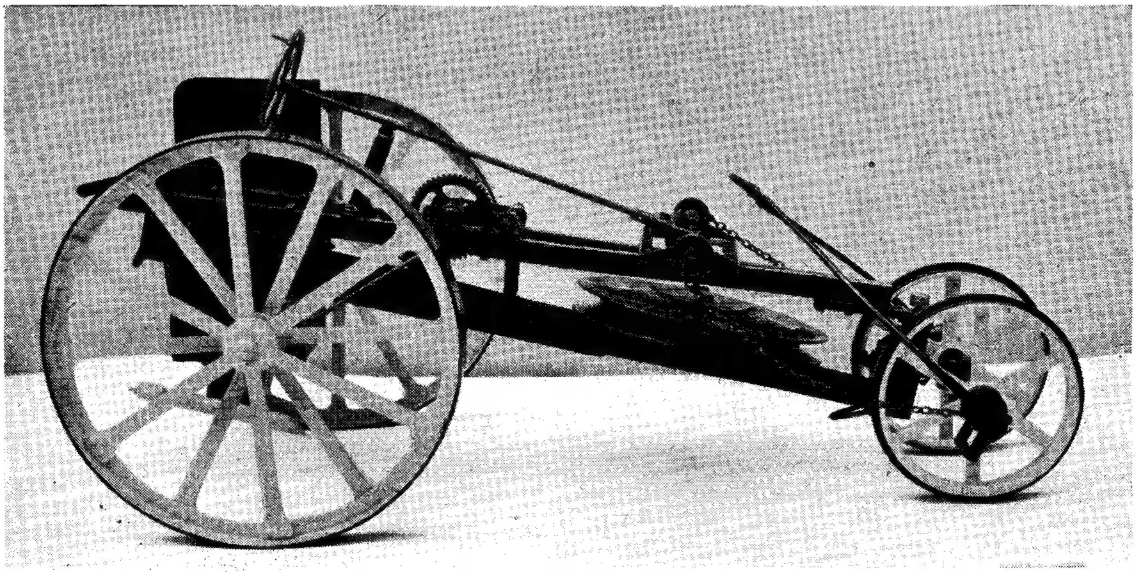




Top left: A traction-engine built to $1\frac{1}{2}$-in. scale by W Dr Urwick of Taplow; this was Commended

Above: Tender and motion of the $1\frac{1}{2}$-in. scale engine

Left: A well-built free-lance engine by boys of Cuckoo Hall Secondary Modern School, Edmonton; awarded a Special Diploma

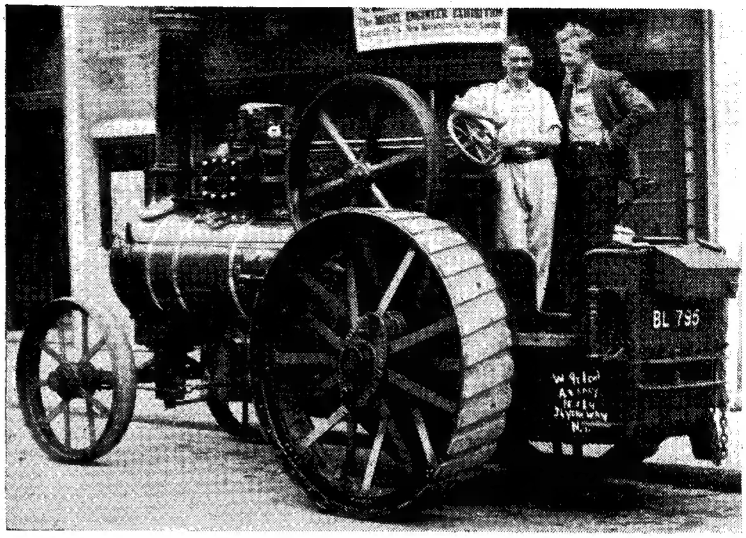


Inch-scale mole-drainer, as used with a steam-ploughing engine, built by R. Palmer of Southampton.

tube was so long and of such a diameter, and thus the size of the boiler was fixed for him !

The same consideration governed the size of the hind wheel rims, which were turned up from some "salvage" steel tube. Schools are *not* well-endowed, especially in these expensive days, and when a comparatively few pounds has to provide tool maintenance and materials for perhaps a couple of hundred boys for six months, then all's grist that comes to the mill !

On the engine, the craftsmanship was really excellent, especially considering the youth of the constructors. The boys concerned can afford to congratulate themselves on their achievement, but at the same time I hope they will not forget how much of the credit belongs to their teacher.



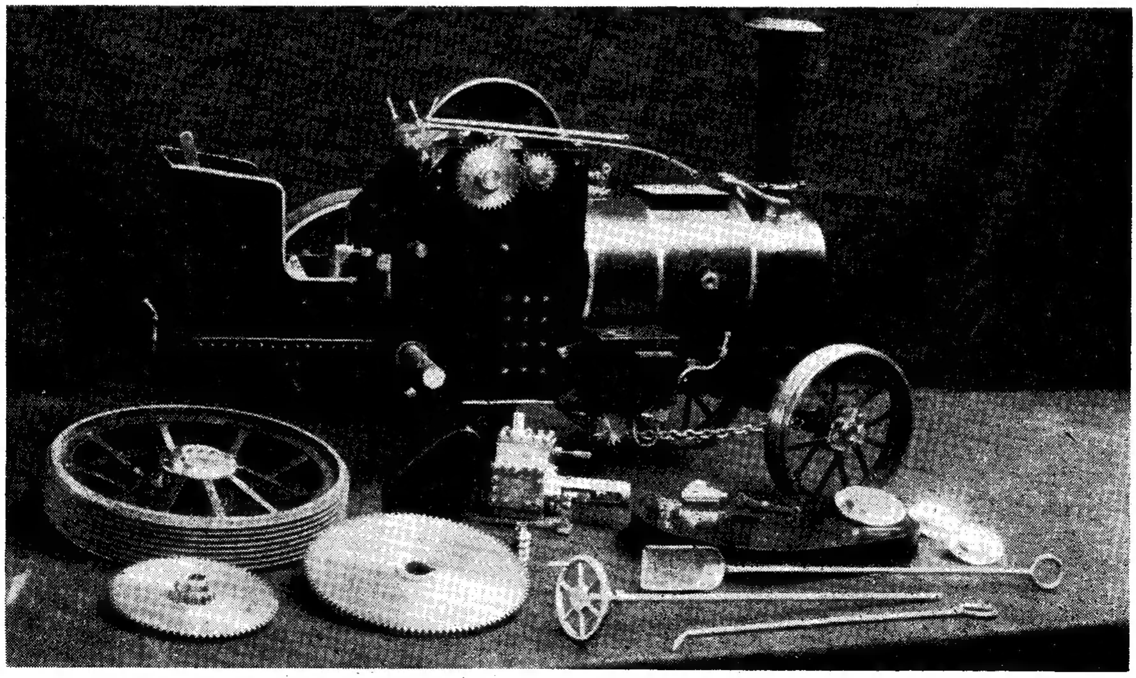
Mr. G. Romanes' Wallis and Steevens "Expansion" engine, "Eileen the Erring," arriving at the 'M.E.' Exhibition

A Mole Drainer

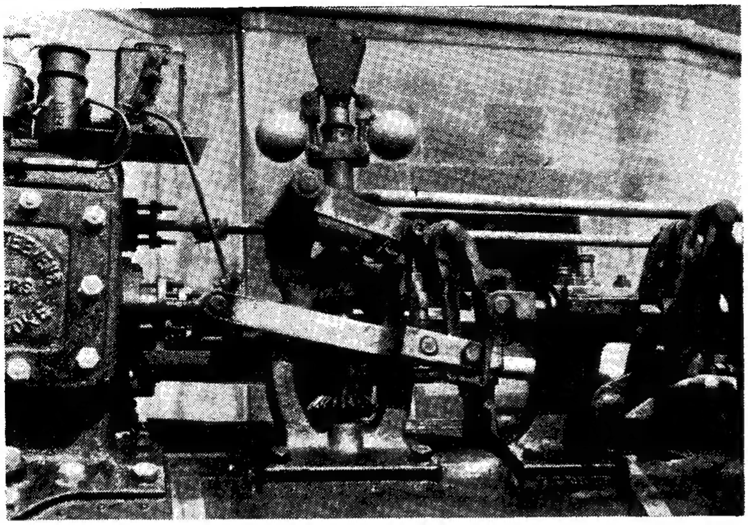
Last year, R. W. Palmer of Southampton showed us a balance-plough as used in steam ploughing—he is building a pair of Fowler ploughing-engines, and very nice they will be, to judge by some snaps he sent me recently. They will certainly be a quite unusual exhibit.

This year, Mr. Palmer sent a mole-drainer, as used with a ploughing-engine, and very few visitors to the exhibition seemed to know what it was all about ! It consists of a frame on four wheels, the front pair being steerable by a man standing at the rear of the machine.

A sub-frame is mounted under the main-frame, and pivoted at the front; it can be lowered or raised vertically by means of a geared-down windlass on the upper frame. Projecting downwards at the rear of the sub-frame is a blade, at the lower edge of which can be seen the "mole," a sharpened steel cylinder. The haulage rope from



The "school" traction-engine partly erected. Gears were cut by the boys themselves. (Photograph by Green, Enfield)



In this view of the Wallis and Steevens expansion-gear, the radius arm is set for late cut-off.

the engine passes round a large horizontal sheave mounted on the sub-frame, to obtain a double purchase.

In operation, a hole is dug at one side of the field, and the mole is lowered into the hole to a suitable depth. The engine, being placed at the other side of the field, hauls the implement forward, the mole thus forcing a passage through the sub-soil below the surface.

Porous drain-pipes are threaded on to a tail-rope attached to the mole, which hauls them behind it and lays them in the passage, preventing its collapse. Thus the field is drained.

A Wallis Expansion Engine

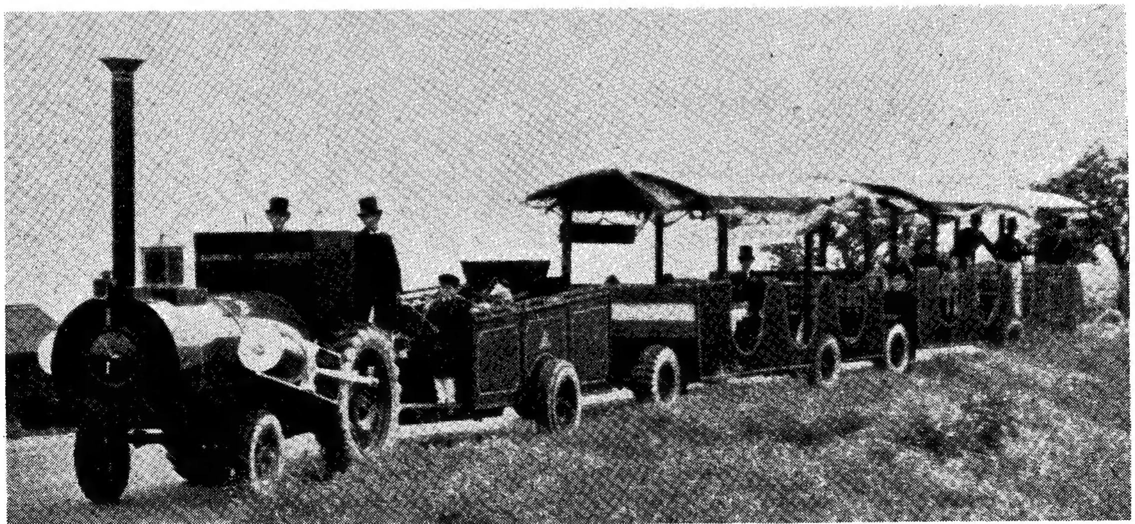
As mentioned in a recent " Smoke-Ring," Mr. Giles Romanes brought along his full-sized Wallis and Steevens traction engine to the exhibition on the first day. *Eileen* is fitted with expansion valve-gear, and perhaps a few words about this may not be out of place here.

There are two slide-valves, one working on the normal port-face, and the second working on the back of the first. Ports are cut right through the inner valve, and by varying the travel of the outer one, the steam may be cut off at varying points in the stroke.

The inner valve is worked by normal Stephenson reversing-gear, and similar gear is also fitted to enable the expansion-valve to be reversed. However, the rod from this gear does not work the expansion-valve direct, but its motion is used to oscillate the curved expansion-link which is suspended from the governor-stand.

A radius arm attached to the die-block which works in this link imparts motion to the expansion-valve, and it will be obvious that as the radius-arm is lifted, so the travel of the expansion valve is reduced. This gives an earlier cut-off. When travelling on the road, the position of the radius-arm is controlled by a lever on the foot-plate, but when driving machinery, it is connected to, and controlled by, the governor.

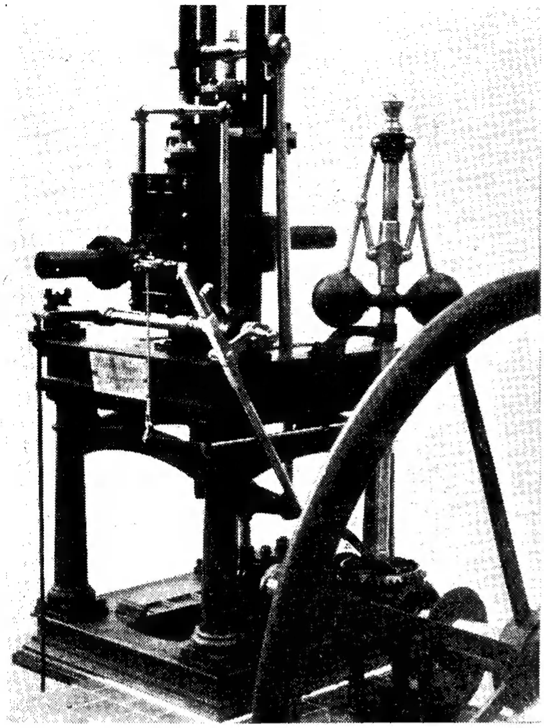
The advantage is, of course, that steam constantly enters the cylinder *at full pressure*, and cut-off varies according to the work actually required, so that the fullest use is made of its expansive property. Consequently the engine is extremely economical in coal and water, a very desirable attribute in any steam-engine !



The Fordson tractor is now a very familiar sight in any agricultural area, and there may be some of us who could wish that they all looked like the one seen above ! But this one was a bright idea on the part of members of the local branches of the National Union of Railwaymen, the Amalgamated Society of Locomotive Engineers and Firemen, and the Transport Salaried Staffs Association at March, Cambs., who entered it as an item in their Coronation Carnival procession

"M.E." Exhibition Afterthoughts

By W. R. Dunn



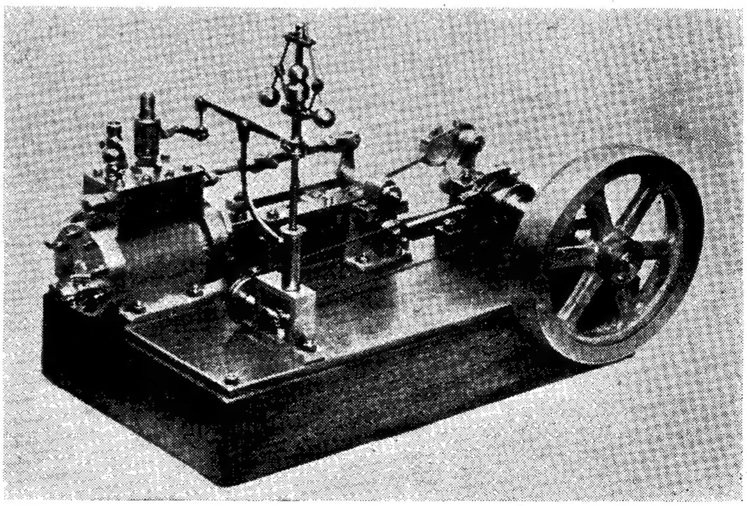
Photograph No. 1. An historic engine revived

OF all the attractions at this year's Exhibition, it is somewhat with regret to have to report that the Engineering side of the Competition Models was sadly below in numbers, as well as the high standard of work, that usually characterises our Exhibition. What perhaps was most astonishing, was that only seven locomotives above $2\frac{1}{2}$-in. gauge were entered this year, and so low a number has never happened at any previous show of recent years. On the first glance at these it was disappointing to note that there was none that stood out as a prospective Cup Winner. The highest award was a Bronze Medal, which went to Mr. R. K. Boardman for his 5 in. gauge S.R. 4-4-0 locomotive, but this had many faults, such as too thin tyres on the front bogie wheels and much too thick tyres on the tender, which was so very obvious at first glance. Then there were no inside wheel splashers, and the coupling-rods and other steel parts were cadmium plated, which much detracted from its appearance. There is always plenty of oil floating around a working steam locomotive to render cadmium plating unnecessary to prevent rusting. Some people even thought the coupling-rods were duralumin, on account of their appearance, which would have been a worse fault still. It is also a pity that some competitors appear to think that their models are likely to gain distinction by embellishing them with decorations of the optical finish order, and scraper markings as seen on microscopes, etc. This fault applied to the otherwise nicely made *Fayette* type locomotive by Mr. R. H. Drummond, and the rather poor fits in the valve gear demerited it. Again, such things as Bluebell polishing of models are definitely given down-grading marks, when being assessed by the judges. In the category of true-to-scale painting and finish, I always remember a model at a show that was outstanding. It was a merchant steamer, and the realism was conspicuous. Even the rust marks were painted on, below the bilge, and auxiliary outlets on the hull, and added to the general effect was its somewhat dirty matt finish, as if it had just come back from rough weather voyaging. Those models with highly polished and glistening paintwork, and nickel plated chains and anchors, are never like the real thing, and should never be seen, other than the painted hulls of racing yachts. Very few full-size locomotives of today have the gloss paint finish that some of the older type had, but I would not say that it would be correct to submit a locomotive model covered with grime and dirt as we see them today in our stations; I don't think that would be favoured by the judges, but the above is just one of the things we have to thank Nationalisation for. A good example of this true-to-scale finish and painting is the model No. R13 by Mr. J. S. Youngman, of the *Puffing Billy*, photographs of which have appeared in recent issues of THE MODEL ENGINEER. You can hardly tell, looking at this, whether it is the real thing or not, and it comes well within the category of truly representative finish and painting and general style of work in that age. It well deserved the Bradbury Winter Challenge Cup, in its class. In the Junior class it would be impossible to miss the locomotive chassis by Master D. B. G. Merrick which deserves special mention. Made up from castings supplied by H. P. Jackson of York, it was a marvellous piece of work for a boy of 15 years, and for sheer merit, it well deserved the Reeves prize of five guineas. I have never seen the like, for one who is practically a schoolboy. He obviously had tuition of a high standard, and judging from his work, great results must be expected from his future attempts. It was a "Schools" Class 3-cylinder engine, illustrated in Mr. J. N. Maskelyne's recent article in THE MODEL ENGINEER on the locomotives at the show, but this does not show the perfection of his machine work, and the fits of all bearings.

In the General Engineering Models, we certainly had a very fine job by Mr. H. Slack, with his elaborate $2\frac{1}{4}$-in. scale steam driven roundabout. It was, in fact, the best example of a fairground galloping horse roundabout we have ever had, and the effect of the little steam organ engine, assisted by gramophone records of the correct variety, with the figures on the organ front operating their instruments, and the wisps of steam from the main driving engine, gave a unique picture of the real thing. Taking some nine years to construct, it very deservedly was awarded the Championship Cup in its class. Another model in the same class was Messrs. Kent and Tapper's $1\frac{1}{2}$-in. scale 6-h.p. table engine. A good deal of research work was entailed in getting particulars of this engine, the original full-size engine having been made by Messrs. Robert Napier

& Co. of Glasgow, in the year 1851, and it has taken about two years to get all the particulars right about it, before any work was entertained. For this and the high standard of workmanship it was awarded a Silver Medal. It is to be lent to the Birmingham Museum, if any readers have not yet seen it. A detail of the perfectly made valve gear and governor, is shown in photograph No. 1.

Turning now from the sublime to the ridiculous, it is a pity I have to pick on exhibit No. J2, which was supposed to represent a mill engine. The photograph is shown herewith, but how Mr. Cheesman, who made it, can reconcile this as a model of a mill engine rather beats comprehension. He surely has never seen such an engine with such out-of-proportion design of crosshead slide-bars in comparison with the size of the cylinder, and surely, mill engines have massive flywheels, which are required to store a large amount of momentum to overcome the fluctuating loads common to mill engines. In starting a job like this, one would have thought that a little care would have been well spent on the design and proportion, on paper, before commencing such an effort. I am sure the judges would consider this example just a waste of workmanship, on account of hopelessly faulty design. A further example of rather incorrect detail was seen in Mr. H. Fenns horizontal engine No. J4 (see photograph on page 274 of the September 3rd issue). It was a nicely made job, but had too large an eccentric strap, which was made of steel, and bushed with gunmetal, which probably caused the strap to look over-sized. In the prototype, an engine of this size, would have a gunmetal eccentric strap. Only in the large powerful marine engines are cast mild-steel straps found, and these are lined with white metal, also the shapes of the crossheads were unconventional, in case the builder wonders at his result. A case of a wrong material, was seen in the balance weights fitted to the otherwise nicely made model of a gas engine, shown by Mr. Dewhirst No. K1, which works on petrol. The weights in question, could just as easily have been made in steel. Those gunmetal weights on the the real engine would have cost much too much! A neat triple expansion engine made from Stuart Turner castings, was shown by Mr. D. W. Broughton, No. J8. It was quite an improvement on the original design. (See photograph in August 13th issue.) Such details as the more correct horizontal cross arms, actuating the link motion, fitted with double brasses, and the more correct cylinder studding all emphasise the care and thought put into it by the builder. The other Stuart Turner engine was a 2 in. by 2 in. vertical engine, by Mr. C. F. Cox, No. J6. This was quite a well constructed job, but this type of engine most usually employed for dynamo driving, or similar forward rotation, was fitted with reverse gear, the operating gear of which was decidedly on the heavy side. A very pleasing and excellently finished job was by Mr. H. V. Davies, a 1-in. scale Grasshopper engine, No. J3, which forms the subject of the cover picture for the September 17th issue. What improved the detail was that the parts were mostly fabricated. For example, the flywheel was completely built up, as were many of the individual parts. The difference seen by this method of construction compared with castings is patently obvious, and at once stamps a model as above the ordinary. This model well deserved the Bronze Medal awarded to it, and I for one, would like to see more of this class of work exhibited. Of recent years we have been badly lacking the good old slow-motion steam engine plant, such as the horizontal tandem compound type of engine. These make admirable models when fitted with Meyer valve-gear, or the heavy mill engine, fitted with Corliss valve-gear, and rope driving flywheels; so, prospective competitors, please note. In penning these notes on the engineering models, I have ventured to make a constructive criticism of the models I have mentioned, with a view to pointing out the errors that so many appear to fall for, in detail and correct scale proportion. I again advocate that all that is necessary to obtain the right sizes of any individual part of a model, is the use of a *scale factor*. If we are building a locomotive, or any other type of engine for example to a scale of $\frac{3}{4}$ in. to a foot, all that is required is to adopt the scale factor of 16. To ensure that your model is correctly proportioned from the prototype, you simply divide the sizes of the full size job by 16, so simple; but how many follow it? If you are in doubt, for example, about the size you should make the hand rails around the locomotive boiler, which are say $1\frac{3}{4}$ in. diameter, then $1\frac{3}{4}$ in. divided by 16 = 0.11 in. diameter or No. 11 s.w.g. The same would apply when ascertaining the size of the big- and small-end diameters of an engine connecting-rod, or the eccentric or eccentric strap sizes; lay a rule on them and divide by 16. If you are making a $2\frac{1}{2}$ in. gauge locomotive, the scale factor is then 22.6. To those who are making a free-lance engine, and not a copy of any particular prototype, from which they can obtain their "scale factor," there is still no excuse whatever for them to make their model hopelessly out of proportion. Everyone has access to an engine room of some kind, and there they should find out sufficient information to allow the use of the necessary scale factor, and thus save their model from being a freak. These remarks in particular, would apply very definitely in the case of the model I mentioned shown in photograph No. 2.



Photograph No. 2. A well-made model badly designed

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

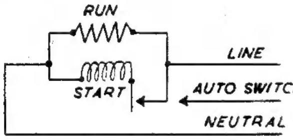
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Connecting A.C. Motor

I recently purchased a second-hand ½-in. capstan lathe fitted with a D.C. motor and a reversing switch of the Dewhurst type. I have now fitted an A.C. motor, and as the wiring for this motor is different from the original, I have been unable to connect up the motor. I obtained a wiring diagram from the makers, but can only get the motor running in one direction.

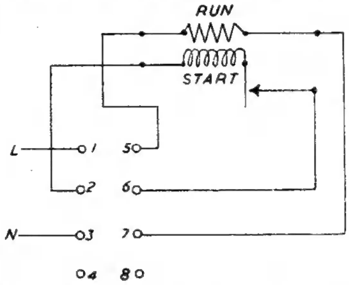
W.K.W. (Hayes).

From the sketch you furnish, it shows your motor connected for one direction of rotation only, because there are only two wires coming out. To enable reversal to be obtained, it is necessary for four ends to be brought out from the windings. The motor will have two windings, one the starting, and one the running winding. Reversal is obtained by changing the direction of the current in either of these two windings; usually, the starting winding is chosen for reversal, but if preferred, the running winding can be used; remember, only *one* winding needs to be changed. In your case, and from the switch makers' sketch, the starting winding is used in this case. In the ordinary way, it is usual to make provision for reversal, whether two or four ends are brought out. There is one exception, however;



Motor as now connected with two ends brought out, non reversing

in some makes of motors the starting winding does not operate on the full line voltage, it is tapped off half the running winding; in this state the starting winding will be operating on half the line volts. With this connection, reversal is unobtainable unless six ends are brought out; it is, of course, possible that your motor may be connected in this way. You can decide this by removing the front-end shield; this should be done carefully, as ends are easily pulled off from the winding. If there are only three ends coming from the windings, then your motor will be non-reversing. If there are four ends, all is in order for reversal.



Motor re-connected with four ends brought out

It is noted in your sketch that there are apparently four positions on the terminal board; you show the two centre ones as being connected to the winding. Are you sure that the two outer terminals are not connected to a part of the winding? Remove this terminal block, and see if wires are connected to all four terminals; if not, and there are four ends, two will be connected to each terminal if this is the case. It is only a matter of separating the wires and arranging them on the four terminals. The running winding will be indicated by a thicker wire than the starting winding; should all wires be of the same size, testing will decide the two respective circuits. The starting winding will be the one in which the automatic switch is fitted.

Model Power Boat Building

As a first attempt at model making, I would like to try my hand at a model power boat. I should be glad to know if you can supply the drawings for the air-sea rescue launch shown on the front cover of THE MODEL ENGINEER *for February 26th last. Failing this, can you recommend any type of boat of which drawings and instructions are obtainable, or any good books on the subject? I am particularly interested in flash steam as a source of power, and should be glad to know if this would be suitable in a prototype boat to give a nice turn of speed. I have been told that flash steam boilers have violent explosive tendencies, and should be glad if you could assure me that this is not so.*

A.J.W. (London, N.W.2.).

We regret that we are unable to supply drawings and instructions for building the air-sea rescue launch referred to. We can, however, supply a number of plans and blueprints for boat construction, and in your case we recommend the 48 in. hard chine hull design, P.B.6, which comprises three sheets and a leaflet giving full instructions, price 12s. 6d. A very useful book for your purpose would be *Model Boat Construction*, by Harvey A. Adam, which can be obtained from our publishing department, price £2 2s.

With reference to flash steam as a source of power, this would be quite suitable for a boat of the type described, and our handbook *Flash Steam*, price 3s. 6d., contains a good deal of general information in addition to drawings of engines and boilers which would help you to construct the plant.

The idea that flash steam boilers have violent explosive tendencies is entirely wrong. As a matter of fact, explosion of the boiler itself is practically impossible, as even if the tube should burst, there is no reserve of steam or water in the coil to produce the violent explosion which would take place if an ordinary boiler were to burst.

Paint and Transfers

Please advise me where I can obtain paint and transfers for a model engine, as I have not seen any advertisement in THE MODEL ENGINEER. *The engine is a 3½-in. gauge "Pamela."*

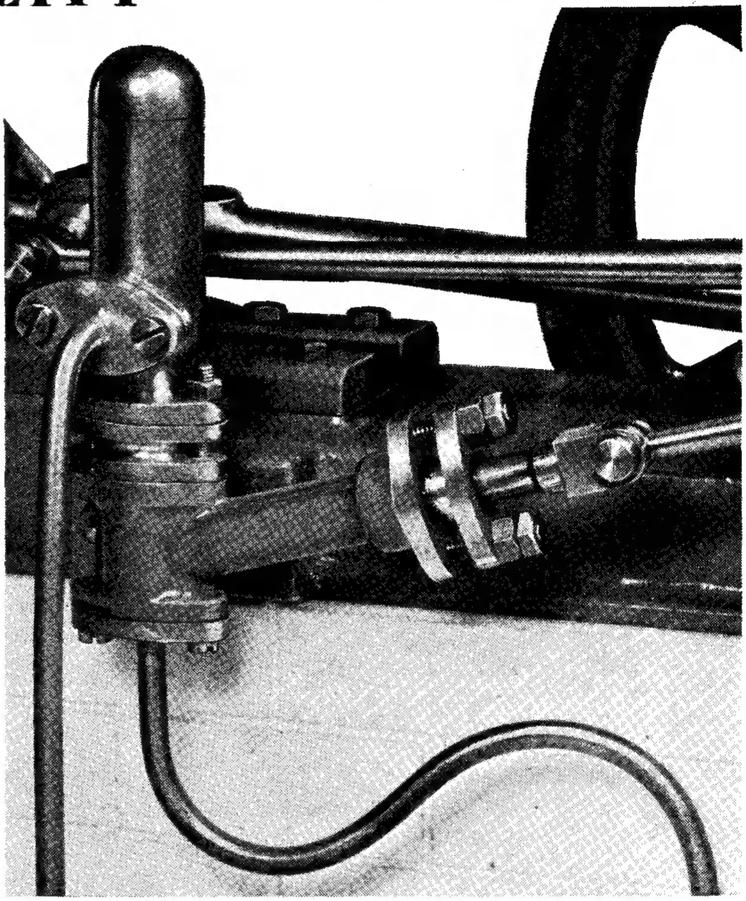
M.C.H. (Bristol).

The colours required are British Railways green for the superstructure, black for wheels and underframes and Post-office red for bufferbeams. Lining is a narrow black stripe with a fine orange line each side, but not touching it.

Bassett-Lowke Ltd. provide special paints for model steam locomotives, but we cannot say where transfers are obtainable. We believe that, as yet, nobody has produced suitable transfers, except for "O" and "OO" gauges. The few examples that we have seen in larger sizes have been hand-painted, and beautifully done at that. American model engineers are much more fortunate than we are in this respect.

MORE UTILITY STEAM ENGINES

By Edgar T. Westbury



A close-up of the feed pump in position. The suction and delivery pipes are temporarily connected, hence the cheese-head screws.

IN reply to the numerous readers who have enquired where to obtain castings and parts for constructing the "Unicorn" engine, I am now able to inform them that they can be obtained from Mr. W. H. Haselgrove, 1, Queensway, Petts Wood, Kent. The only reason why I did not announce this earlier was because Mr. Haselgrove has had a long and serious illness, and I did not wish to embarrass him with a flood of business enquiries at such an inopportune time. Happily, however, he has now made an excellent recovery, and is able to devote full attention to the matter.

Readers who visited the "M.E." Exhibition may have noticed that the "Unicorn" engine appeared there unobtrusively as a loan exhibit, together with a sample set of castings, which were of a quality conforming to the usual Haselgrove standard. I may mention that the engine was closely scrutinised by many experienced model engineers, and apart from a few minor criticisms, was accepted as a highly suitable subject for the constructor who is looking for a simple engine which is not a travesty of correct prototype practice.

Feed Pump

This is an optional feature, but for an engine which has to run for substantial periods under steam, some means of replenishing boiler feed-water is a necessity, and the only alternatives to a power-driven pump of some kind are a steam injector or a hand pump, either of which must be operated at fairly frequent intervals, so that the services of a full-time "engine driver" are required. By the use of a feed pump driven directly from the engine, it is possible to adjust the rate of feed to coincide fairly closely with that of the steam consumption, assuming that the load variation is not excessive. In conjunction with the governor, therefore, the fitting of the feed pump enables the plant to work more or less automatically.

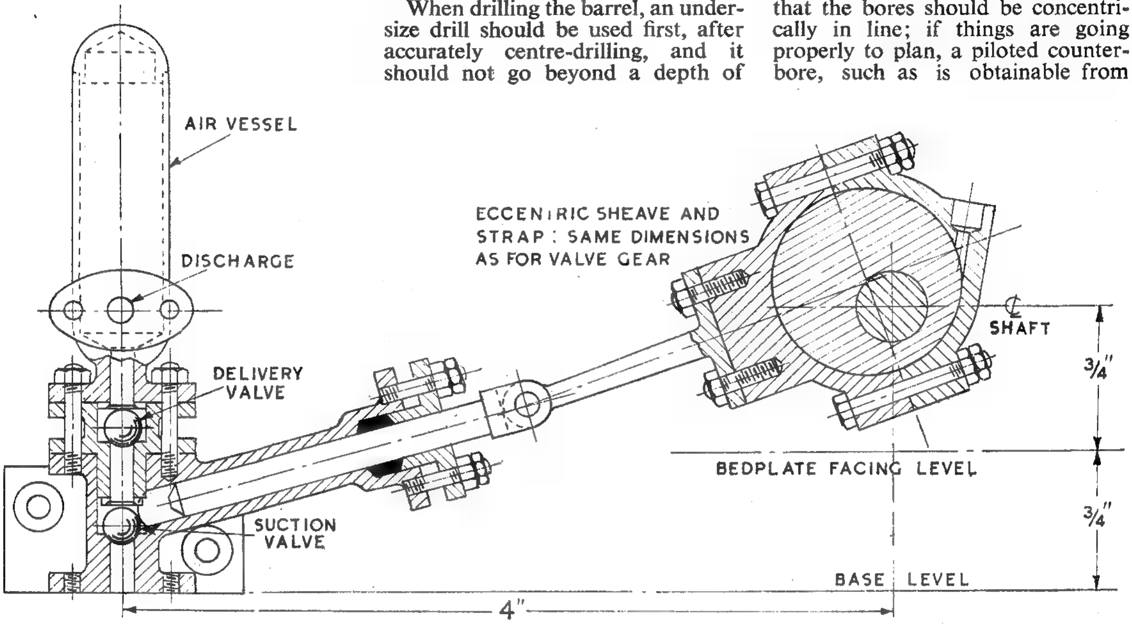
In the original construction of the engine, no provision was made for fitting the pump, and it was necessary to fabricate a suitable facing for its attachment on the side of the bedplate casting. This, however, has now been made an integral part of the casting, as may be seen from the detail drawing of the above component, and it requires only to be filed or machined flat, square with the horizontal surfaces, and parallel with the main centre line.

The pump is of more or less conventional type, and calls for no explanation of its working principles, except possibly in respect of one item, namely, the provision of an air vessel over the delivery valve, which is not very common in the feed pumps fitted to models, though it is almost universal in full-size stationary engine practice. This device, by trapping air in the closed space above the level of the discharge outlet, provides a resilient cushion which damps out violent fluctuations of pressure in the system. Not only does this steady the flow, making it to all intents and purposes continuous, but it provides a remedy for the annoying and sometimes dangerous effect known as "water hammer" in the discharge pipe. This rarely gives much trouble in very small pumps, it is true, but it can be a source of unnecessary noise, which may be mistaken for a symptom of mechanical slackness in bearings.

Continued from page 381, *September* 24, 1953.

All the parts of the original pump were fabricated by silver-soldering, but castings will be available which considerably reduce the amount of work entailed in construction. In the case of the body it is quite simple to cast this integral with the valve chamber, but the provision of a mounting plate presents an awkward moulding problem, so it is arranged for this to be made casting, as it ensures both bores being parallel with the mounting face, and holds the work quite rigidly. A protractor may be used to assist in setting the pump barrel at the correct angle, but if this is not available (as in my own case), a template of thin metal, or even cardboard, set out on the drawing board, will serve the purpose for work which does not call for super-precision.

When drilling the barrel, an under-size drill should be used first, after accurately centre-drilling, and it should not go beyond a depth of drilled too deeply, the drill will go through solid metal all the way, and no difficulty should be found in keeping it true, but go cautiously, "just in case." However, if it should run into the other hole, proceed only as far as the depth of the counterbore, and open this out to size with a boring tool, then use the centre-drill again to enable a true hole to be drilled for the rest of the way. It is most essential that the bores should be concentrically in line; if things are going properly to plan, a piloted counter-bore, such as is obtainable from



General arrangement of feed pump

separately from a piece of 1/8 in. brass plate, 11/16 in. by 1¼ in., and attached to the lug at the back of the casting by two 6-B.A. screws. This may with advantage be done at the outset, the face of the lug being filed or machined flat, and parallel with the centre line of barrel and valve chamber, before drilling and tapping the screws. As it is unlikely that the mounting plate will ever have to be removed, it may further be secured by sweating, or even silver-soldering; in either case a fillet is automatically produced all round the joint which strengthens it and improves appearance.

After checking the flatness of the back of the mounting plate, and filing the screw heads flush if necessary, this face may be used to mount the component on a small angle plate for machining the barrel and valve chamber, using toe clamps over the corners of the plate. This is a much better method than the use of chucking pieces on the

1 7/16 in. from the flange face. It is not practicable to finish the bore with an ordinary reamer, but a D-bit can be used with advantage, and is easily made from a piece of 3/16-in. silver steel. As the pump does not rely on the fit of the plunger in the barrel, however, the finish left by a drill is satisfactory if it is only used to take out a few thousandths of an inch, and the corners of the cutting edges are honed to a slight radius. The gland can be counterbored with a drill, if care is taken to see that it runs truly and does not snatch (it is helpful to hone the *flutes* of the drill to produce negative rake in this case), but a piloted cutter is better.

The casting may now be swung round on the angle plate for boring the valve-chest. After facing the top flange, it is centre-drilled, and drilled right through with a No. 15 drill, to allow of finishing with a reamer. If the barrel has not been

Kennion Bros, or Buck and Ryan, may be used. Set the casting on a stepped pin mandrel for facing the under side flange.

Delivery Housing

For making this, it is recommended that a "stick" of oval-section bronze should be used, as this serves also for making the gland and pipe flanges, all of which are the same dimensions over the face. It can be held in the four-jaw chuck, and machined all over at one setting except for finishing the spigot, then parted off. The same care should be taken to ensure that the bore and counterbore are accurately in line, as in the previous case. To finish the lower flange face and spigot, the stepped pin mandrel may again be used. Note that the mouth of the hole is slightly countersunk, so that it helps to keep the ball valve properly centralised. The cross-slotting of the spigot may be carried out while

the component is mounted on the mandrel, by clamping the latter in the toolpost, and using a $\frac{1}{16}$ in. slotting cutter, preferably of small diameter, such as a Woodruff key-seating cutter, which will produce a concave cut and thereby increase the area of the passage. But if facilities for this operation are not available, it is possible to file the slots.

Air Vessel

As it is impracticable, or at least very difficult, to cast this component hollow, it is made with a separate top piece which must be attached after boring out the inside. The casting is first chucked with the top outwards in the four-jaw chuck, one jaw bearing on the delivery flange face (unmachined as yet), and set truly for drilling and cleaning up the outside as far as the flange will permit. It is not desirable to drill the $\frac{1}{8}$-in. hole right through at this setting.

After this operation, it is just as well to make the domed head and secure it before proceeding further. The outside contour need not be finished, but should be roughed out, and the spigot turned to a tight fit in the bore of the air vessel. It is possible that this would be quite secure if sweated in with soft-solder, but silver-soldering is much safer. Afterwards, the casting can be rechucked to run as truly as possible, and the head finished off neatly by means of a hand tool.

The casting may now be held across the face of the chuck, one of the jaws of which may need to be reversed, so that the delivery flange can be centred for drilling and facing. Following this, it is chucked with the lower end outwards for facing the end, drilling, turning the spigot and the flange face. The mouth of the hole is chamfered and the spigot slotted in the same manner as the previous component, but care is necessary in this case to see that the slot does not cut into the flange face.

Gland

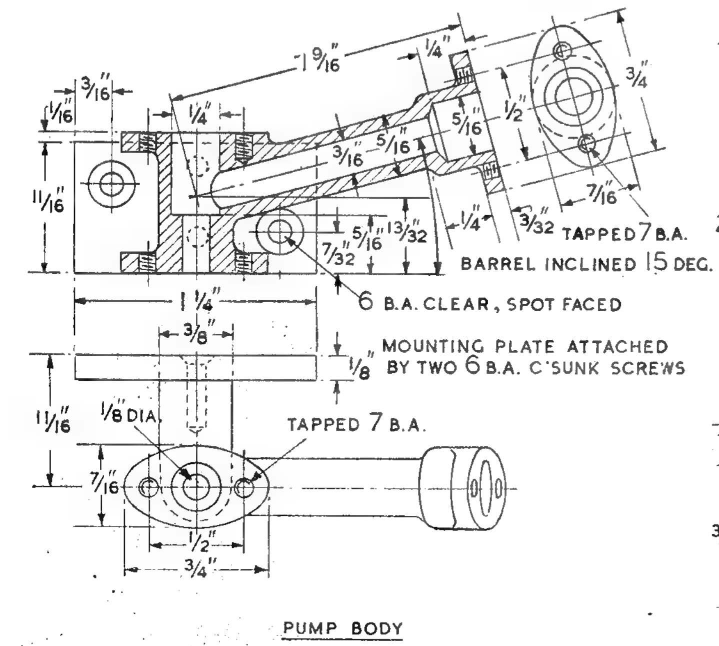
This can also be made from the oval cast stick, and is a straightforward operation, which calls for no comment except the obvious one that the bore and spigot should be quite concentric with each other, and a good fit to their mating components. While the stick is set up, two pieces 3/32 in. thick may be drilled $\frac{1}{8}$ in. diameter, and parted off to serve as delivery and suction pipe flanges; these are not shown on the drawings but are obviously necessary for connecting up; they may be provided with bosses to strengthen the junction with the pipes, especially if the latter are soft-soldered in.

If cast material is used for these parts, the edges of the flanges will, of course, need to be cleaned up. A good deal of work may be saved on this operation if the cast stick, before machining, is filed up all over to remove surface irregularities; one might go even further and produce an accurate finished surface by draw-filing, and following up with emery cloth, so that all that is necessary after machining is to remove the burrs from the corners.

In my own case, I had no pre-formed material, but had to use stock bar; to avoid having to shape each flange separately, however, I rigged up a simple eccentric turning jig which enabled one side of a length of bar to be machined to a circular arc, after which it was indexed 180 deg., and the other side treated likewise. The minor radii could not be machined in this simple fashion, but it was a fairly easy matter to file these after forming the sides. This process is similar to my well-known method of forming convex-flanked cams, which has been successfully employed in several of my petrol engines; if readers require a more detailed explanation I shall be pleased to furnish it.

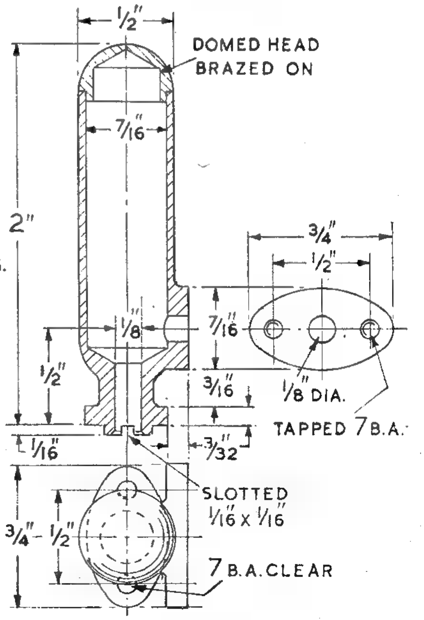
Plunger

This may be made from nickel-silver, hard bronze, or stainless steel, and may either be turned from $\frac{1}{4}$ in. square section material, or fabricated, using finished round bar, screwed or brazed to the square



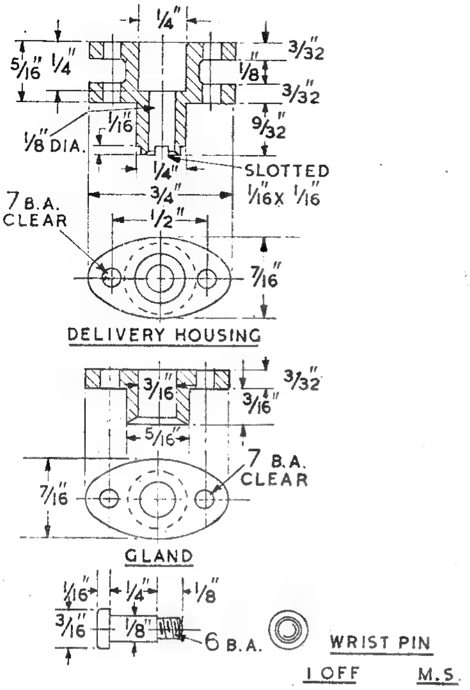
PUMP BODY

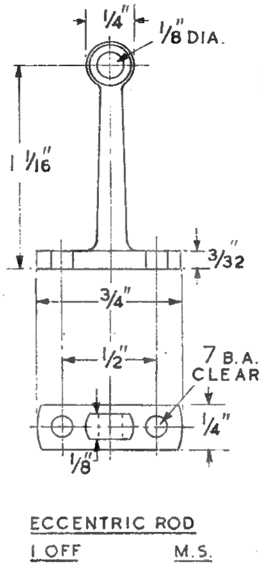
1 OFF BRONZE



AIR VESSEL

1 OFF BRONZE





knuckle head. The exact length of the plunger may possibly have to be adjusted on assembly, as it is desirable that it should have the minimum clearance at the end of the stroke, without actually fouling the spigot of the delivery housing. It is important that the surface of the plunger should be perfectly smooth and parallel; this matters much more than its dimensional fit, as the gland provides the pressure seal, but it should not be so slack that there is a danger of the packing being squeezed out. The knuckle is drilled and slotted as described for other similar components, and the wrist pin, of mild steel, is also made and fitted in the same way.

Driving Gear

A short eccentric-rod, similar to that used to operate the valve gear, but considerably shorter, as shown in the detail drawings, connects the plunger to the eccentric strap, which is identical with that described for the valve-gear, and the same applies to the eccentric sheave. The "timing" of the latter on the crankshaft is immaterial, but for the sake of symmetry, it is a good policy to set it in opposite phase to the crank.

Assembly

An important factor in the successful operation of the pump is the correct seating of the two ball-valves, which are $\frac{3}{16}$ in. diameter, of stainless steel. Various methods of ensuring a tight seating of this type of valve have been used; for obvious reasons, they cannot be "ground in" to their individual seatings like "mushroom" valves, as this would produce a score-mark on the ball which would only register with the seating about once in a million times. The special virtue of a ball-valve is that the whole of its surface is available for contact with the seating, and in practice it does actually keep rolling, so that whatever wear takes place is evenly distributed. A method of seating ball-valves which I have found highly successful is to use a piece of steel rod the same diameter as the ball, rounded off to an approximately spherical end, and used on the seating, first as a lap, with a mild abrasive such as aluminium oxide, and then cleaned off and used as a burnisher, with oil only. It is best to run the valve chamber in the lathe and apply the tool by hand, but if this is not convenient, the reverse order of application may be used; in either case, a slight wobbling motion is advisable to prevent scoring the seating. Do not make an excessively wide seating; only a few seconds' application will suffice to take off the sharp corner, which is all that is necessary or desirable in practice.

The valves should not have more than about 1/32 in. lift, the suction valve being given the most if there is any difference at all. In pumps designed to work at high speed, the lift of the valves is often critical, and it may be necessary to provide means of fine adjustment, but that will not be necessary in this case. I have run the "Unicorn" engine at speeds up to 1,000 r.p.m.—far beyond its normal range—and found that the pump functions perfectly, producing pressure up to 400 lb. per sq. in. If the delivery line is closed, the pressure will build up, compressing air into the air vessel, till it produces a "hydraulic lock," which is not good for the mechanical drive, or the engine itself, so some means of escape—through the boiler check valve or bypass—should always be open.

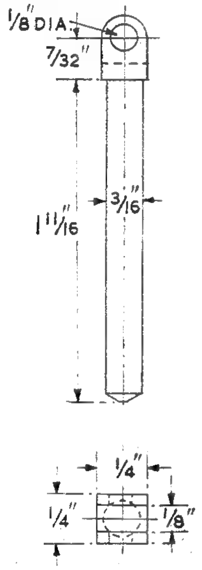
If it should happen that through excessive caution, the bore of the barrel has not been drilled clear through into the valve chamber, the operation may be completed afterwards, but great care must be taken not to run the drill in so far as to damage the valve seating, which would be disastrous. The best way to avoid this is to hold the drill in the chuck with just sufficient length projecting to complete the bore, and no more. It is sure to snatch as it runs through obliquely to the wall of the valve chamber, but this precaution will limit its progress, by using the face of the chuck jaws as a positive stop.

When attaching the pump to the facing on the bedplate, a check should be made to ensure that the centre line of the barrel intersects that of the crankshaft; to assist in lining up, a piece of straight $\frac{3}{16}$-in. rod sufficiently long to reach the latter may be temporarily inserted in the barrel. The pump is then clamped in place for spotting the position of the tapping holes for the fixing studs.

The correct packing for the plunger gland is tallow-impregnated cotton, plaited in three strands and cut into separate rings, which are inserted in the annular space with the joints staggered. This is much better than winding a continuous length of packing round the plunger. The strands of cotton can be obtained from the material known as "candle-wick" sold for craft work, or teased out from a hank of cotton waste, if one has patience. Asbestos packing, as used in steam glands, can be used as a substitute, but is not so durable as cotton for water glands; and graphite, though perhaps the best

of all lubricants, will betray its presence by blackening the plunger.

A very important point with small feed pumps is to make all pressure joints and glands absolutely bottle-tight. A steam engine will work, albeit uneconomically, with clouds of steam exuding from all joints; but the slightest air leak will put even a fair-sized pump completely out of action. It is sometimes stated that the suction line, and the suction valve, are the most important, on the principle that "if you can get water into the pump, it is dead certain that you can push it out again." This is all very true, but the logic, such as it is, does not go far enough. For instance, if the delivery valve is leaky, or not dropping promptly on its seating, it is clear that water delivered through it on the inward stroke will be forced back into the barrel on the return stroke, much easier than lifting a new charge through the suction valve. Similarly, an air leak at the top flange of the valve chamber, or at the gland, will result in air being drawn in and expelled instead



PLUNGER

1 OFF STAINLESS S.

of water. It follows, therefore, that *all* possible sources of leakage are equally important and must be eliminated.

Another important factor in the success of a small pump, which has often been emphasised in THE MODEL ENGINEER, but will bear further repetition, is the elimination of unnecessary "dead" space in the valve chamber or barrel. Even when leakage is precluded, it is possible for a certain amount of air to get into the pump, and if this is not immediately expelled, it will accumulate in a bubble which expands and contracts with the variation of pressure on the inward and outward strokes, thereby lowering volumetric efficiency (i.e. the proportion of water displaced in relation to the actual plunger displacement), possibly to the point at which discharge ceases altogether. It is almost impossible to avoid some dead space in the pump, but it must always be kept to the minimum, by avoiding large valve pockets, and ensuring that the plunger projects as far as possible into the barrel. The higher the working pressure, the less dead space can be permitted.

For pumps which have to work fast, the critical factor is the design of the valves, the object being to ensure that they provide adequate passage area, and are arranged so as to open and close promptly under the minimum pressure difference. This is also influenced by the inertia of the valves, so that they must be made as light as possible. These observations are not of paramount importance in the present case, but they have a bearing on feed pump design generally, and may be found helpful to readers who have encountered problems in getting pumps to work efficiently.

(To be continued)

OUR COVER COMPETITION

LOCOMOTIVES — launches — traction engines — steam ships — marine steam engines — cars. These are the types of model visitors to "The Model Engineer" Exhibition this year like best, according to the votes cast in the competition run on THE MODEL ENGINEER stand.

Visitors to the exhibition were invited to study ten covers of THE MODEL ENGINEER and to select the six which showed the type of model they like best, placing them in order of preference. Over three thousand visitors entered the competition and analysis of their votes shows the following result, expressed in per centages :—

Locomotives 100 per cent.
Launches 67.2 per cent.
Traction Engines 64.6 per cent.
Steam Ships 62.4 per cent.
Marine Steam Engines 45.2 per cent.
Cars 43.1 per cent.
Speedboats 41.9 per cent.
Stationary Steam Engines 31.7 per cent.
I.C. Engines 27.5 per cent.
Representational 13.7 per cent.

Every vote cast is included in these figures, whether for a first or a sixth place. Day by day as the results were checked and analysed it was both interesting and exciting to note movements in the voting. From the start it was clear that locomotives were going to win by the proverbial mile, but there was a great battle between launches, traction engines and steam ships for second, third and fourth places. Launches early took the lead and in fact held second place throughout. Steam ships were third for five days, with traction engines fourth. On one occasion only eight points separated them and we had visions of a recount. On the sixth day however, these positions were reversed and held to the end.

Meanwhile a similar battle was raging between marine steam engines, cars and speedboats. Marine steam engines were seventh for three days, went up into fifth place for a day, dropped to sixth for three days and then came back into fifth place in the end. Cars started out in sixth place, but dropped to seventh after three days, came up to fifth for two days and then went back to sixth place, in which they finished. Speedboats were fifth for three days, then sixth, fifth again, and finally dropped to seventh, in which place they finished. Stationary steam engines, I.C. Engines and Representational were eighth, ninth and tenth throughout.

The winning line in the competition, therefore, proved to be E C A D F B, and, subject to a final scrutiny the result of the competition is as follows :—

Only one competitor submitted a correct vote—Mr. Leslie Ronald Christian of "Hazon," Acklington, Northumberland, who receives a voucher valued £25. Congratulations Mr. Christian.

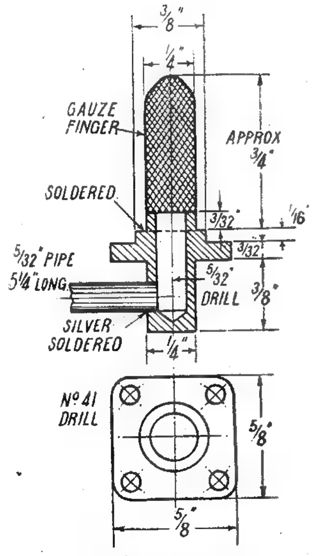
Second prize goes to Mr. D. W. Lye of 9, Station Approach, Orpington, Kent, whose entry was E C A D F G. Mr. Lyle receives a voucher valued £15.

Third prize is divided between Mr. R. Warboys, 18, King James Street, London, S.E.1., and Mr. Neville Sismey, 30, Ramsey Road, Benwick, March, Cambridgeshire. They each voted E C A F D B —the right six types, with the fourth and fifth in the wrong order. They each receive a voucher valued £5.

L.B.S.C.'s "Britannia" in 3½ in. Gauge

ERECTING THE BODY OF THE TENDER

BEFORE starting any plumbing jobs, it will be necessary to erect the tender tank on the frames. On the ordinary type of tender, we usually bolt the soleplate to the frames, and then fit the body and build up the tank on top of it; but as there isn't any soleplate on *Britannia's* tender, the proceedings are a bit different. The first job is to drill all the screw-holes in the angles along the top edges of the frames, and in the top of the buffer-beam. Eight No. 41 holes will do nicely, starting at ½ in. from the end, and spacing them evenly at 1 3/16 in. centres. Drill three in the top of the buffer-beam, one in the middle, and one at 1½ in. on each side, at ½ in. from the edge. Stand the tank body on the chassis, and set it so that the back end comes just flush with the back edge of the frame, leaving the thickness of the buffer-beam projecting. Make sure that an equal amount overhangs the frames at each side. Temporarily fix the



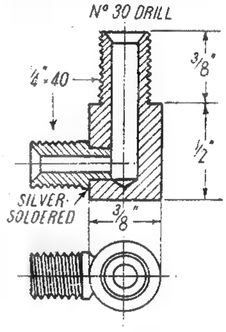
Feed water fitting

body in place; I don't suppose that anybody has a cramp big enough to go over the whole issue, so the only thing to do, is to wind a piece of wire or string around the lot, at each end, which should do the needful. Anyway, it doesn't matter a Continental what fakement you use, as long as the tank can't shift on the chassis while you are drilling.

Put the No. 41 drill through all the holes in the angles and the buffer-beam, and carry on right through the tank bottom. Clear away any burrs left inside the tank; I use a scraper made from an old flat file, ground off square at the end, and the teeth ground off at both sides, to leave two sharp edges. It makes a nobby tool for jobs like this, and it will reach inside the tank quite easily. The tank can then be fixed to the chassis by 3/32-in. or 7-B.A. brass screws put through from the inside and nutted underneath. If cheese-head or round-head screws are used, the heads must be soldered over inside the tank, to prevent leakage; they can be reached with an ordinary soldering-bit through the opening at the top. It just requires a little careful manipulation. Countersunk screws could be used, as the nuts would pull down the tapered heads into the drilled holes, in the same way as a union nut pulls down the cone into the seating, and no leakage should occur. A taste of plumbers' jointing on the threads, should help matters in that direction.

Feed and Bypass Pipes

The general layout of the feed and bypass pipes was shown in the last instalment, by full lines in the elevation, and dotted lines in the plan. A square-flanged fitting carrying a gauze strainer, will be needed for both the pump and injector feeds. If castings are not available, they can be made from bar material; brass would do quite well, as there is no movement, and consequently no wear. Either ⅝ in. square, or ⅞ in. round, can be used. Chuck truly in four-jaw, or three-jaw, as the case may be, face the end, and turn down ⅜ in. length to ¼ in. diameter; part off at ¼ in. from the shoulder. Reverse and rechuck in the three-jaw. Turn down 5/32 in. length to ⅜ in. diameter, and further reduce 3/32 in. length to ¼ in. diameter. Centre, and drill down for ½ in. depth with 5/32 in. drill. If round bar has been used, file the flange to the shape of a square, with ⅝ in. sides and rounded corners, as shown in the drawing; if square bar has been used, it will only need rounding off at the corners. Drill a No. 41 hole in each corner. In the side of the round part, opposite one of the square facets, drill a hole with No. 23 drill; and in it, silver-solder a 5¼ in. length of 5/32 in. thin-walled copper tube. Roll up a finger-shaped strainer from fine-



Hand pump and bypass fitting

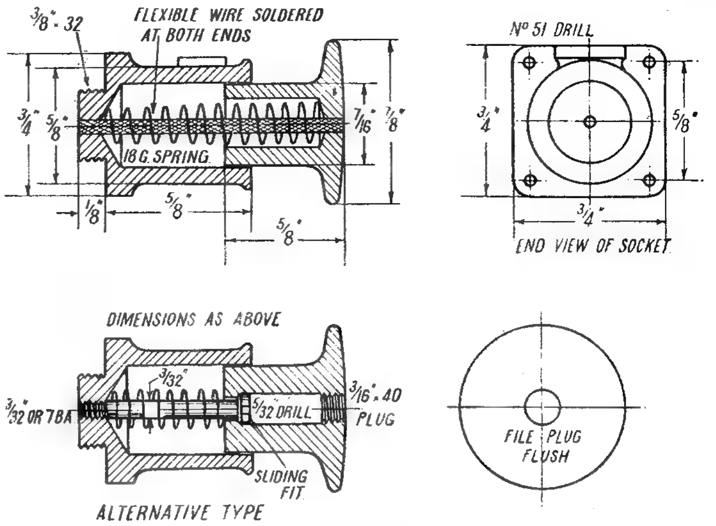
mesh brass or copper gauze, about ¾ in. long, squeezing the top over tightly; then solder it to the reduced part of the fitting above the flange, as shown.

Turn the tender upside down on the bench, and put the fittings in place, the pipes running direct to the underside of the drag-beam, as shown by the dotted lines in the plan. Run the No. 41 drill through the holes in the flanges, making countersinks in the tender bottom. Remove, drill the countersinks No. 48, right through the tender bottom and the thickening-piece; tap 3/32 in. or 7 B.A. Replace the fitting with a 1/64 in. Hallite or similar jointing gasket between the flange and the bottom of the tender and secure with round or cheese-head brass screws. A bent-strip brass clip may be fitted close to the drag-beam, to support the pipe as shown; no water-regulating valve will be needed on the injector feed-pipe, as we have already fitted one on the engine.

The fittings for the hand-pump feed-pipe, and the bypass pipe, are exactly similar to each other, and can be made from ⅜ in. round brass rod. Chuck in three-jaw,

face the end, turn down ⅜ in. length to ¼ in. diameter, and screw ¼ in. × 40. Centre, drill down to ¾ in. depth with No. 30 drill, and part off at ½ in. from the shoulder. At $\frac{3}{16}$ in. from the blank end, drill a 5/32 in. hole in the side, breaking into the centre hole; and in this, silver-solder a ¼ in. × 40 union screw. Make a couple of ¼ in. × 40 lock-nuts, ⅛ in. thick, from ⅜-in. hexagon brass rod. Put these fittings through the ¼ in. holes in the tender bottom, with the unions pointing forward, and put the lock-nuts on inside the tank, making sure that they are screwed down very tightly.

The top of the hand-pump feed fitting (left-hand side) is connected to the union on top of the hand-pump by a swan-neck of 5/32-in. copper pipe, furnished with a union nut and cone at each end, a simple job needing no detailing out. See the elevation in the last instalment. The connection from the union at the bottom, to the engine, is made by a 10 in. length of 5/32-in. copper pipe with a union nut and cone at the pump end. This pipe goes straight to the underside of the drag-beam (see elevation and plan) and unlike the usual hand-pump feed pipes, is not coiled; it is supported by a clip at the front end, as shown in the illustration, and the end is curved downwards. This end will carry a flexible connection strong enough to withstand the pressure when the hand pump is used at any time; this is merely a short length of stout rubber tube as used for tyre pump connectors. One end is pushed over the copper tube and secured with a clip, and the other end carries a union nut and lining, for coupling up to the union under the engine drag-beam. An actual cycle-pump connector, with a braided covering, would make a nobby feed-bag, and can be obtained from any cycle dealer. Just cut off the cycle-pump fittings, and substitute the ¼ in. × 26 union nut and lining. A couple of turns of thin wire, wound around the end of the copper pipe, and soldered, would thicken up the end sufficiently to prevent the end of the connector from coming off, if a weeny clip is fitted around it; and the end of the union lining, where it enters the connector, could also be served likewise.



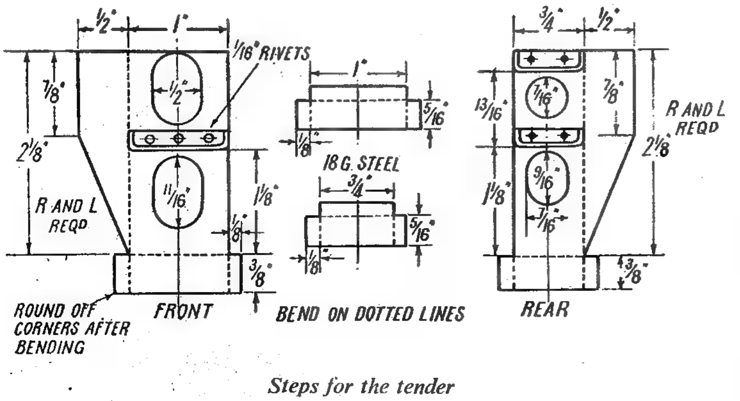
Tender buffers

That section of the bypass pipe under the tank, is precisely similar, only it runs outside the frames in the same way as the injector pipe. It is clipped up, as described above, near the drag-beam. Inside the tank, a piece of 5/32-in. pipe approximately 6 in. long, will be needed, with a union nut and cone on one end. This is attached to the top of the fitting in the tank bottom, and the open end of the pipe is led to the underside of the filler, so that the end is visible through the hole. The amount of water being bypassed, is thus seen at a glance, by opening the filler lid. The pipe should be stiff enough to stand up on its own, without need of moral or physical support, though a clip may be fitted if the builder desires.

Steps and Buffers

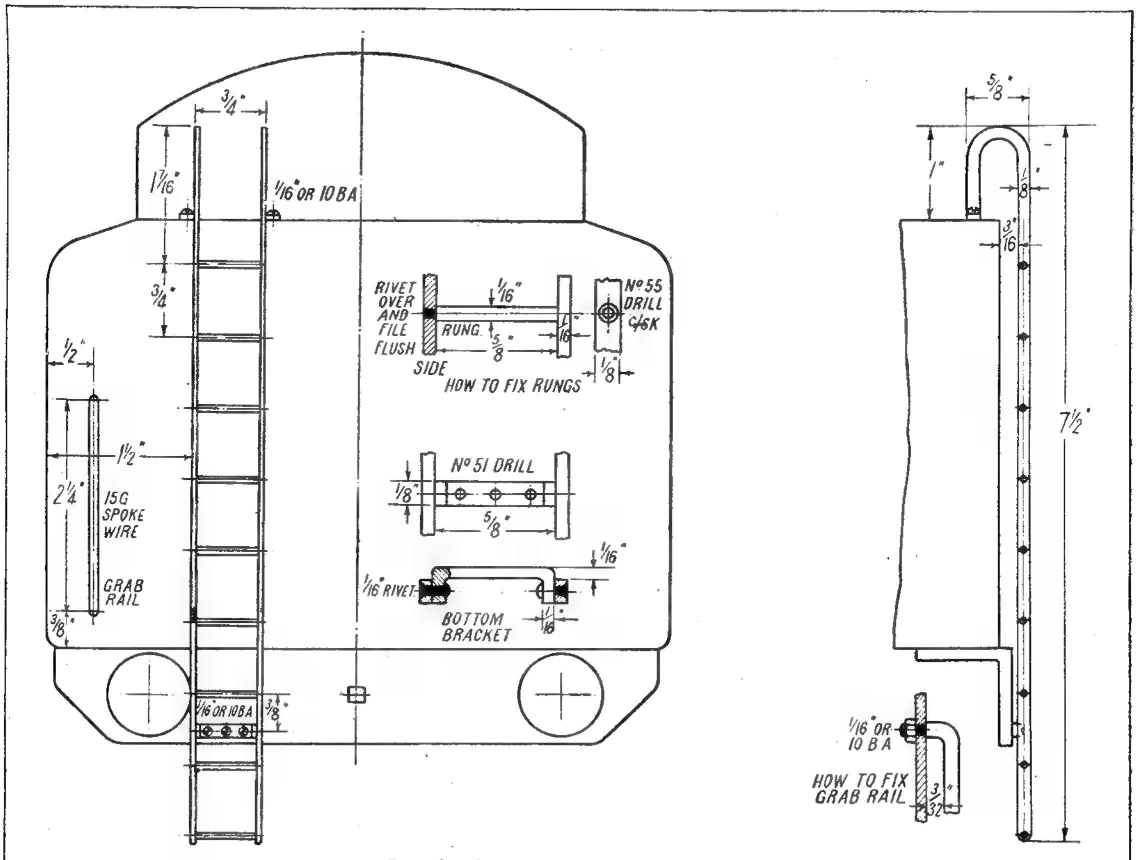
The tender brake gear will need an instalment all to itself (the next one, if all goes well) so we might as well save time, and make some of the trimmings. The steps at the front and back of the tender are simple bent-metal jobs, all dimensions being given in the accompanying drawings. The bent-over flange at the side, is attached to the beam by three 3/32 in. screws, nutted behind the beam. A piece of 16-gauge sheet steel can be placed over the front ends of the frames, on top of the beam, like a footplate, and fixed to it by screws tapped into the beam. This should be the same length as the beam, and should extend from the edge of the beam, to the front plate of the tender body. You can see the edge of it in the general arrangement drawing, above the front step.

Owing to the buffer centres being so close to the frame centres, there is no room for a projecting buffer spindle on the inner side of the beam, so the buffers have to be kind of "self-contained." I have shown two different types, both suitable for the job in hand, so you can please yourselves which you adopt. In the first, the heads are hollow,



Steps for the tender

like those on the Stroudley engines of the L.B. & S.C.R. in order to accommodate a longer spring. As there is no spindle and nut to prevent the heads coming out, I have shown the device successfully adopted for other engines described in these notes, viz.: a piece of flexible wire, as used for hanging pictures, passing through holes in the head and socket screw. This should be soldered at long plain stem, is inserted into the tapped hole in the back of the socket, through the hole in the head. This screw prevents the head coming out of the socket when the pressure on the buffer is released. The screw can be turned from a bit of 5/32-in. steel rod, or made from 3/32-in. silver-steel, with a separate head screwed or silver-soldered on. The end of the hole is plugged with a follow up with No. 55, tap $\frac{1}{16}$ in. or 10-B.A., and put weeny hexagon-headed screws in. Don't leave it too long before applying to Inspector Meticulous for your well-earned medal, or he might run out of stock! The drawbar, and the screw-coupling, are made exactly as described and illustrated for the engine, so there is no need to go through all the ritual again.



Details of the step ladder and grab rail

both ends with the buffer in the normal extended position, and any that projects beyond the head, should be filed off flush. The wire allows the head to be pushed right home, but won't let it jump out of the socket when the head is released.

An alternative is shown for those who don't fancy the flexible wire stunt. In this case, the head is the same as that on the engine, but it is drilled, counterbored and tapped at the flanged end as shown. The spring is placed in the socket, the head put in, and a screw with a bit of screwed steel rod, and filed off flush. If it ever has to come out, which is very unlikely, simply drill a hole in the middle, and knock the tang end of a file into the hole. Turning the file anti-clockwise, will unscrew the plug.

To erect the buffers, drill a No. 51 hole in each corner of the socket flange, same as the buffers on the engine. Screw the short stems into the tapped holes in the beam, setting the flanges square with it; then, using the holes in the socket flanges as guides, run the No. 51 drill in, making countersinks on the beam,

Ladder

The American practice of fitting a ladder to the back of the tender, is much better from the fireman's point of view, than the British conventional steps riveted to the back of the tank. Although the ladder isn't as easy to make, nor as expensive, as one made by catching a nylon on a nail, it only needs a little care and patience. The sides can be made from strip steel, of $\frac{1}{8}$ in. × $\frac{1}{16}$ in. section, and the rungs from $\frac{1}{16}$-in. wire or rod; even this flimsy material is " over scale," but the

(*Continued on page* 433)

Model Power Boat News

BY MERIDIAN

THE 1953 GRAND REGATTA

FOR several years in succession the huge entry list for the Grand Regatta has presented a problem for the organisers, and one of the biggest worries has been the possibility of a really wet day for the event. At the start of the regatta this year it looked as though the worst fears had been realised. Steady rain had been falling since the early hours of the morning and the prospect was gloomy, in spite of a favourable weather forecast. Some 90 minutes or so after the start, however, the rain cleared and fair weather prevailed for the rest of the day.

The regatta was held at Victoria Park, the day following the close of the " M.E." Exhibition, and the spectators included many visitors who had learned of the event from the Model Power Boat Association stand, in fact quite a number postponed their return home to various parts of the country in order to see the regatta.

Entries had to be in before the day, in order to take part, and some 40 racing craft together with over 90 free-running boats had been entered ! Perhaps, luckily (for the organisers !) about a dozen of this large entry failed to participate, either due to non-arrival or mechanical failure of some kind. Thanks to the stout efforts of the stewards, every event went like clockwork, and at the end of each race, the competitors for the next event were all prepared and waiting with their boats.

Straight Events

The events for the free-running boats included the Prototype competition, besides the usual Nomination Race and Steering for the famous Steering Trophy. The Prototype event is judged during the other two events, as steering and reliability are both taken into account. The judges were E. Bowness and R. Allen and the scoring was very close. For the first time in many years the Cup was won by a launch-type boat—G. Caird's fine *B.O.A.C. 51*, which has featured at many regattas this year.

The Nomination Race over course of 80 yd. is always a close thing with so many boats taking part, and the error must be small to stand a chance of a place. The long course is the bane of many boats, as although a boat may be fended off by the stoppers along the sides, it often ruins the " nomination " if the boat fails to complete the distance in a clean run.

This year the first place went to Mr. W. Blaney (Victoria) with the spit-fired *Lil' Man*, who was only ½ sec. out in an estimated 100. Other places were taken by Messrs Innocent (Victoria), Curtis (Kingsmere) and King (Welling). The launches of the Forest Gate club looked fine as they went down the course, and the clear reference numbers on these boats were an example to other boats on which they were not so well displayed, or a minus quantity !

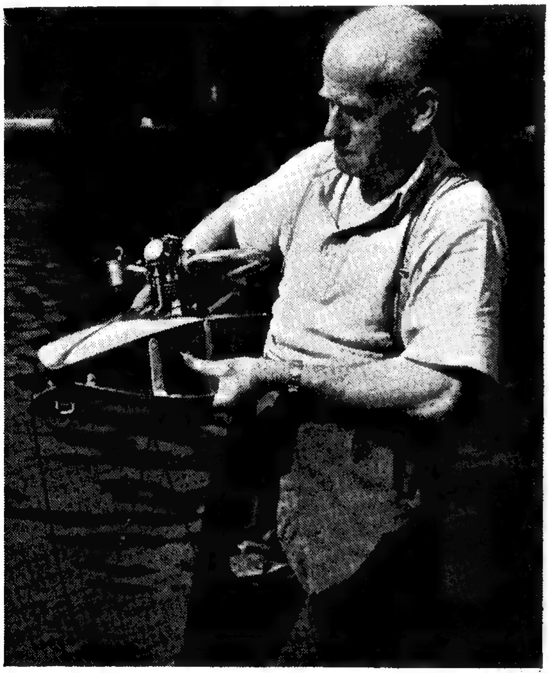
For the Steering Competition a stiff course of about 65 yd. together with a strong head wind proved too much for many of the boats, and the number of boats ending with a score sheet of 0-0-0 was much

A group of competitors in the Prototype events

higher than usual. In spite of this, interest was well maintained and the final result was in doubt right to the last.

The popular winner of the Steering event was A. Squire (Kingsmere) with the fine steam launch *Comet III*, who scored a bull and two inners to make a total of 11 points. D. Saunders (St. Albans) scored 9 points with a little i.c. engined launch to take second place, and a tie for third between Messrs. Skingley and James, both of the Victoria Club, ended favourably for the former. The prototype boats suffered badly by the aforementioned wind, and quite a few almost reached the targets only to turn aside at the last moment—most galling for the unlucky competitors !

" Straight ahead for the target ! "—Mr. J. H. Benson directs Mr. Robinson (West London) with his tug " Elsie "



A veteran record-breaker, Mr. S. H. Clifford (Victoria) with his " A " class boat " Blue Streak "

Speed Events

Conditions were not really favourable for speed, as the water surface was not very smooth. This particularly applied in the early part of the day when the 10 c.c. boats were on the line.

Timing commenced on the ½ lap in all cases and this also had the effect of reducing the average speed. Nevertheless, as there were a number of capsizes, this may not have been a bad feature since some boats would not have finished the course had a longer start been allowed.

The " C " Restricted Race for the E.D. Trophy was won by W. Everitt (Victoria) with *Nan* 2 at a speed of 44.66 m.p.h. with S. Poyser (Victoria) second with *Rumpus* 7 at 44.27 m.p.h. Both in this race and the following Class " C " Race the boats were not very happy, with the exception of the winner of the Victory Cup —*Foz* 2, owned by R. Phillips (S. London). This boat put up a magnificent run of 57.6 m.p.h. and showed little signs of instability. C. Stanworth (Bournville) came second with *Mephisto* 4 at 44 m.p.h. and R. Mitchell (Runcorn) third with *Gamma* 2.

Class " B " entries were more numerous than usual, but the speeds were not any better than the previous races. R. Mitchell (Runcorn) won the event with *Beta IV* after a first run had ended in a spectacular capsize. The speed on the second run was 43.89 m.p.h. T. Dalziel (Bournville) was second with *Naiad* 2

Right: Mr. Lambert (St. Albans) takes careful aim with his steam-driven destroyer in the Steering Competition

in a well deserved place after ■ season of hard luck.

The " big boys " in the Class " A " race for the Speed Championship put up the best show in the way of speed, although it should be noted that the water was a little calmer at this time. Only 0.6 seconds separated the first and third places in this race and several other boats were not much behind. J. Benson (Blackheath) with *Orthon* was first at 57.9 m.p.h., second E. Clark (Victoria) with *Gordon* 2, 56.19 m.p.h. and third N. Hodges (Orpington) *Rita*, 55.88 m.p.h. Other competitors with good speeds were: J. Ward (Orpington) *Dina* who recorded 52.18 and W. Brightwell (Wicksteed) who achieved 51.39 on the first run and then had to withdraw with universal joint trouble. The Crebbin Trophy went to B. Pilliner (Southampton) with *Eega Beeva* which made ■ fine run at 52.18 m.p.h.

Altogether some 26 different clubs had representation among the competitors, and this is believed to be something of ■ record for a single regatta.

Special mention should be made of the P.A. equipment loaned and operated by Mr. J. Ward, which made a considerable contribution to the success of the regatta.

Results

Nomination Race, 80 *yd.*
(1) W. Blaney (Victoria), *Lil' Man*: 0.5 per cent. error.
(2) J. Innocent (Victoria), *Betsy*: 1.2 per cent. error.
(3) F. Curtis (Kingsmere), *Korongo* 1.5 per cent. error.
(4) J. King (Welling), *Jean*: 2.8 per cent. error.

E.D. Trophy, " *C* " *Restricted* 500 *yd.*
(1) W. Everitt (Victoria), *Nan* 2: 44.66 m.p.h.
(2) S. Poyser (Victoria), *Rumpus* 7: 44.27 m.p.h.
(3) J. Pinchin (Blackheath), *Barracuda*: 42.09 m.p.h.

Victory Cup, Class " *C* " 500 *yd.*
(1) R. Phillips (S. London), *Foz* 2: 57.6 m.p.h.
(2) C. Stanworth (Bournville), *Mephisto* 4: 44 m.p.h.
(3) R. Mitchell (Runcorn), *Gamma* 2: 39.7 m.p.h.

Steering Trophy
(1) A. Squire (Kingsmere), *Comet III*: 11 points.
(2) D. Saunders (St. Albans): 9 points.
(3) J. Skingley (Victoria), *Josephine* 8 points + 3.
(4) F. James (Victoria): 8 points + 0.

Mears Trophy 500 *yd., Class* " *B* "
(1) R. Mitchell (Runcorn), *Beta* 4: 43.89 m.p.h.
(2) T. Dalziel (Bournville), *Naiad* 2: 43.1 m.p.h.
(3) F. Jutton (Guildford), *Vesta III*: 39.67 m.p.h.

Speed Championship, Class " *A* " 500 *yd.*
(1) J. Benson (Blackheath), *Orthon* 57.9 m.p.h.
(2) E. Clark (Victoria), *Gordon* 2: 56.19 m.p.h.
(3) N. Hodges (Orpington), *Rita*: 55.88 m.p.h.

Crebbin Trophy (for fastest flash steamer)
(1) B. Pilliner (Southampton), *Eega Beeva* 52.18 m.p.h.

" *M.E.*" *Prototype Cup*
(1) G. Caird (Bromley), *B.O.A.C.* 51.
(2) J. Skingley (Victoria), *Josephine*.

"BRITANNIA" IN $3\frac{1}{2}$-in. GAUGE

(*Continued from page* 430)

weeny fire-escape can't be made any lighter, if it is to stand up to the handling that falls to the lot of Curly locomotives that earn their living. All dimensions are given in the drawing, the insets showing how the rungs and lower supporting bracket are fitted.

Beginners and inexperienced workers may perhaps find ■ bit of difficulty in bending the swan-necks at the top of the ladder, without kinking the thin material. It can, of course, be heated; but an easier way would be, to do the same as I once did with some eccentric rods, which had tricky bends in them. I just marked the outlines on ■ bit of steel plate, cut them to shape, and no bending was required. In the present instance, use a bit of 16-gauge bright steel plate, mark out the complete side of the ladder, including the curved top, and saw and file the two plates together, just the same as when cutting out frames.

Mark off and drill the holes for the rungs, while the sides are still together; or if you have bent the sides from strip, clamp together while drilling. It would be just too bad for the unfortunate fireman, whose boot soles might be oily, to slide from side to side when trying to climb a ladder with what the kiddies call " wonky " steps ! Slightly countersink the holes on the outside; and after cutting the rungs to length, chuck each in the three-jaw and turn down each end for about 3/32 in. length, to fit tightly in the holes. Put all the rungs in one side first, and be mighty careful how you rivet over the ends into the countersinks. Thin wire bends very easily; but if the rungs are held in the bench vice, with copper or brass clams over the jaws, there isn't much fear of bending them. One thing you can be mighty thankful for—it won't be such ■ heck of a job to enter the spigots of the rungs in the other side of the ladder, as it was to get all the pivots into the side plate of my (deleted by censor) chime clock ! After riveting over the second lot of spigots, file both sides flush. At the ends of the swan-neck, the sides of the ladder are bent at right-angles, drilled No. 51, and attached to the top of the tank by $\frac{1}{16}$-in. or 10-B.A. screws. As these will come right at the edge of the angles, file nicks in the angle to clear them, then solder ■ small strip of brass to the underside of the angle, just long enough to take the ends of both screws. The holes for these can be located with the ladder temporarily in place. The lower end is attached to the buffer-beam by aid of ■ channel-shaped bracket, details of which are given in the drawing. This can be riveted to the ladder and screwed to the beam, as shown. Don't fix the ladder permanently yet, as it will have to be removed when fitting the brake gear, otherwise it might get damaged.

Grab-rails

The grab-rails on the back of the tender are made from pieces of 15-gauge spoke wire, approximately $2\frac{3}{4}$ in. long. Turn down $\frac{1}{8}$ in. of each end to $\frac{1}{16}$ in. diameter, screw $\frac{1}{16}$ in. or 10 B.A., and bend at right-angles as shown. At $\frac{3}{8}$ in. from the bottom, and $\frac{1}{2}$ in. from the sides of the back sheet of the tank, drill No. 51 holes, with another at $2\frac{1}{4}$ in. above each; poke the grab-rail spigots through, and secure with brass nuts inside the tank. Alternatively, the ends need not be screwed at all, but just bent over, poked through No. 50 holes drilled in the tank sheet, and soldered. If an extra posh job is required, plated spoke wire could be used; plated spokes can be purchased at any cycle shop. Next stage, tender brakes.

How to Grind Small Tools

By "Duplex"

WHEN sharpening the smallest boring tools or others of the kind intended for fine work, it will often be found that even a light application to the ordinary form of grinding wheel will remove far too much metal, and the working life of the tool is thereby greatly shortened. Clearly, what is required is a small grinding wheel of fine grit that will remove hardened metal but slowly, so as to enable the tool's cutting edges to be touched up, or the angles at the point corrected, before any harm is done by excessive grinding. The electric grinder, illustrated in Fig. 1, has been in use for many years, and is always relied on where the smallest boring tools have to be resharpened with the removal of the minimum amount of metal from the cutting edges. The motor formed part of a ventilating fan and is of the series-wound, commutator type designed for direct current working; but this presents no difficulty, as some of the other motors in the workshop are supplied by a rectifier from the a.c. mains. Nowadays, small motors of this kind are usually made with laminated pole-pieces and are of the universal type. The motor is mounted in gimbals carried in a U-shaped casting which is, in turn, secured to the wooden base by means of a central bolt passing through the footing.

In the base of the original stand, a series resistance was housed to provide for both slow and fast running.

The resistance, together with its switch, was removed and remounted on the baseboard of the machine; this enabled the full power and speed to be utilised when the tool was applied to the grinding wheel, but the speed could be kept down while the motor was running light. Although these old-time motors were, as a rule, very well made, the bearings may be found worn if lubrication has been neglected; however, it is a simple job to make and fit new phosphor-bronze bushes to the armature shaft to centralise the air-gap. The commutator should also be examined and, if worn out of truth or pitted on the surface, remachining in the lathe will be needed. Attention should, also, be given to the brushes to make sure that they bed evenly and do not give rise to sparking.

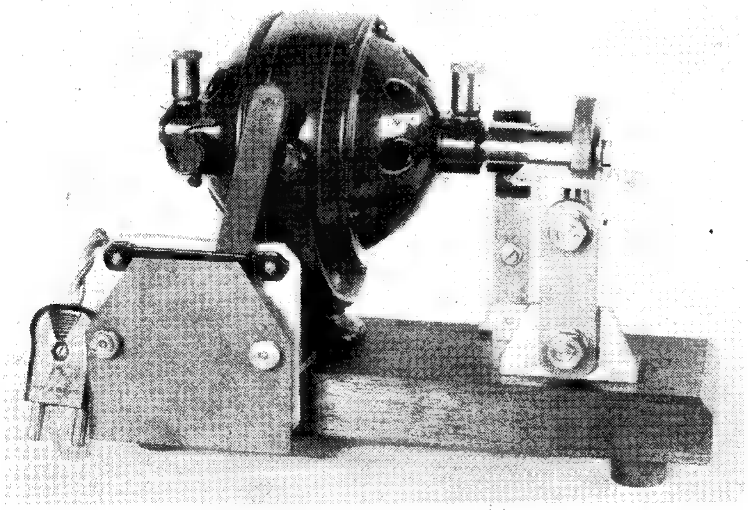


Fig. 1. The finished machine

The Grinding Wheel

For fine work, India abrasive wheels have been found particularly useful, as they have the advantage that they can be impregnated with oil to prevent overheating and loading of the wheel with metal particles. As an alternative, a felt pad can be arranged to provide the wheel with a continuous supply of oil, as is done when sharpening carbide tools on a diamond wheel.

These India wheels are made in a wide range of sizes and in three grades: fine, medium, and coarse. The wheel is mounted on the special extension arbor shown in the drawing; this is accurately bored to fit the motor spindle and is retained in place by means of an Allen grub-screw.

As will be seen in the photograph, a brake has been fitted to serve as an additional control of the motor speed, for with a series-wound motor there is sometimes the danger that the motor, when running light, will go on increasing in speed until the armature windings are destroyed by centrifugal force.

The pressure of the felt brake pad on the wheel arbor is readily ad-

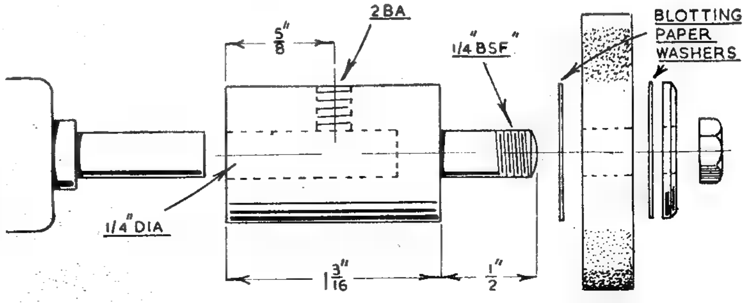


Fig. 2. The spindle arbor and whee. mounting

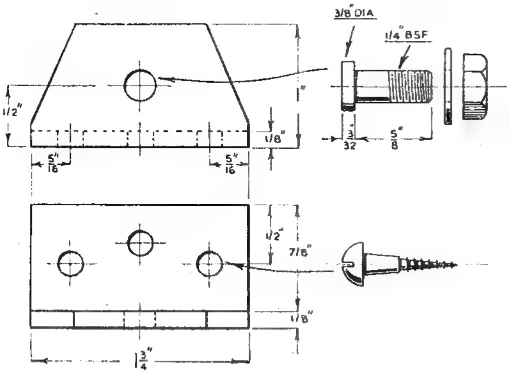


Fig. 4. The foot bracket for the grinding rest

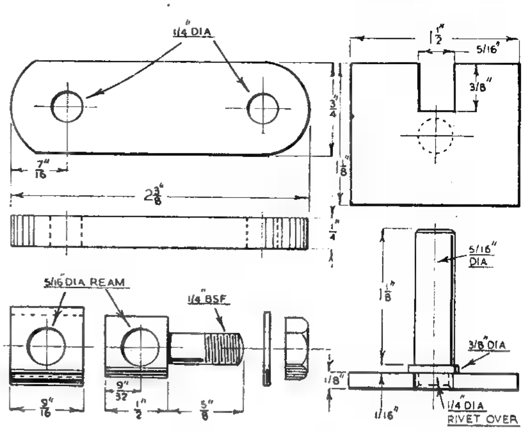


Fig. 5. The grinding rest arm, table, and clamp

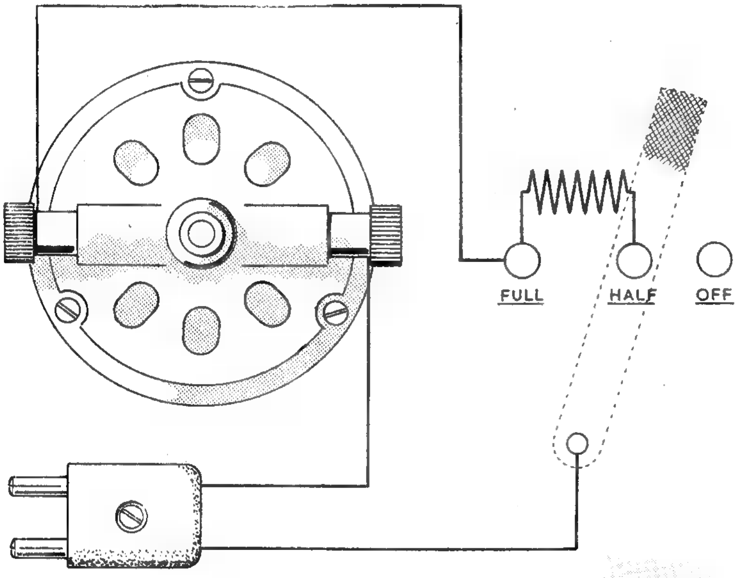


Fig. 7. The motor and switch wiring connections

justable by means of a knurled finger-screw.

The Grinding Rest

The form of toolrest fitted can be adjusted to set the grinding angle, and it will save time if standard clearance and rake angles of, say, 5 deg. and 10 deg. respectively are adopted, so that the rest can quickly be set with the aid of a sheet-metal gauge. In addition, the table can

(*Continued on page* 437)

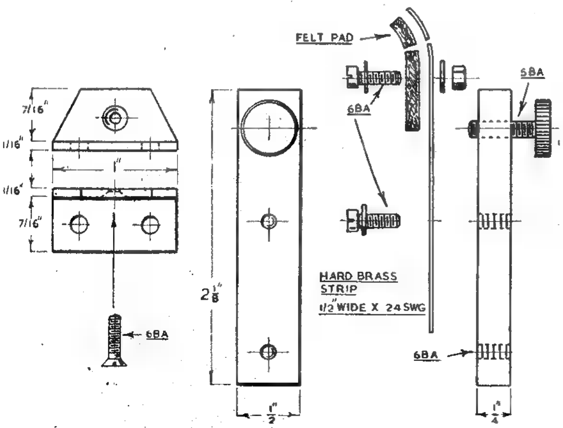


Fig. 6. Details of the wheel brake

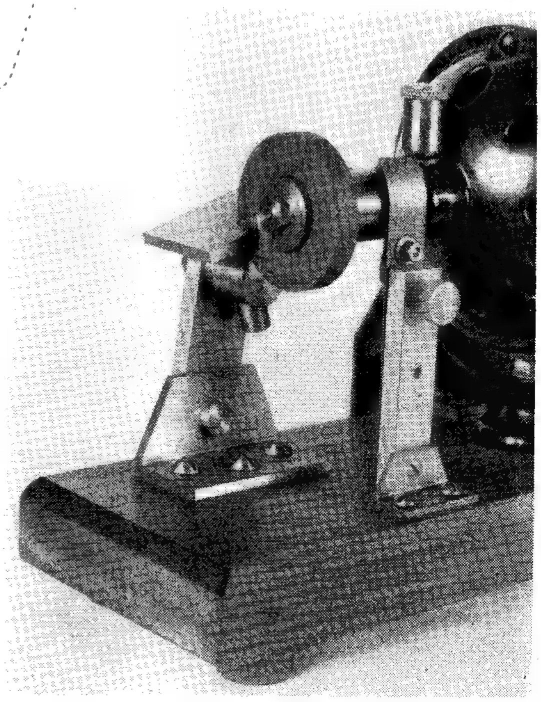


Fig. 3. Showing the grinding rest and motor brake

Modifications to a "SUPER-RELM" LATHE

By A.E.U.

MOST amateur engineers must have doubted the accuracy of their chucks, and had trouble removing the odd bit of swarf that often gets jammed in the threads of a backplate. The main fault of the usual arbor nose fitted to small lathes, is that a certain amount of tolerance must be incorporated, and the overhang from the front journal must be kept down to a minimum; the plain location and retaining screw thread must share the available overhang. My lathe was no exception to the rule, but until the arbor was badly worn I did nothing about it. However, the replacement of the arbor and journal bearing shells eventually became a necessity due to wear.

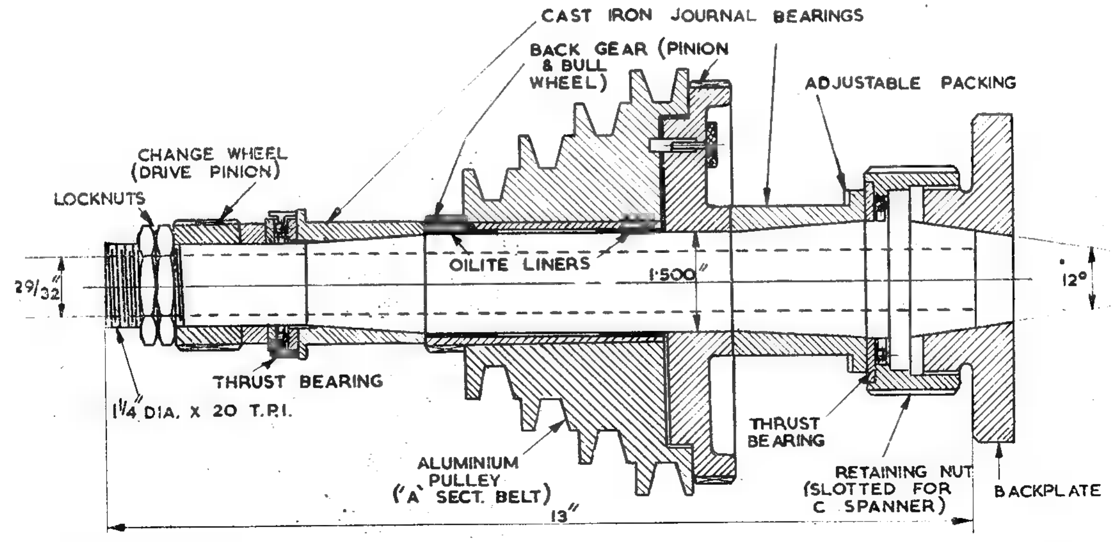
I had for some time admired the arbor nose of many American lathes, where the method, basically was very similar to a normal union fitting: the arbor nose had a male taper and the chuck backplate a female taper and external retaining thread. The bearing housings of my lathe were only split one side, so adjustment was very difficult, and for some time I had been toying with the idea of taper journals so as to be able to adjust the clearance in the journals to suit the oil used and to find the minimum clearance possible. I had written to the Shell oil company giving all the details of the proposed arbor and shell dimensions, materials, and conditions of operation, but all they could advise was 0.001 per in. clearance using Shell Vitrea oil. Needless to say I didn't follow their advice—the discarded shells had less clearance than that, and even with S.A.E. 50 oil I still encountered chatter. The present arbor has settled down at about 0.0006 in. inclusive clearance using Raleigh cycle oil, and gives no trouble either starting from cold or overheating from continuous running—and most important, no chatter!

The question of bearing material was also a problem, I had not been satisfied with the phosphor or manganese bronze shells that my lathe had been fitted with. Eventually I decided on cast-iron, hand scraped to the arbor; several facts helped my choice, the long wear resistance of small cheap lathes fitted with integral bearings bored in the head casting, its resistance to wear in machine slides, the work hardening of bearing surface and its cheapness.

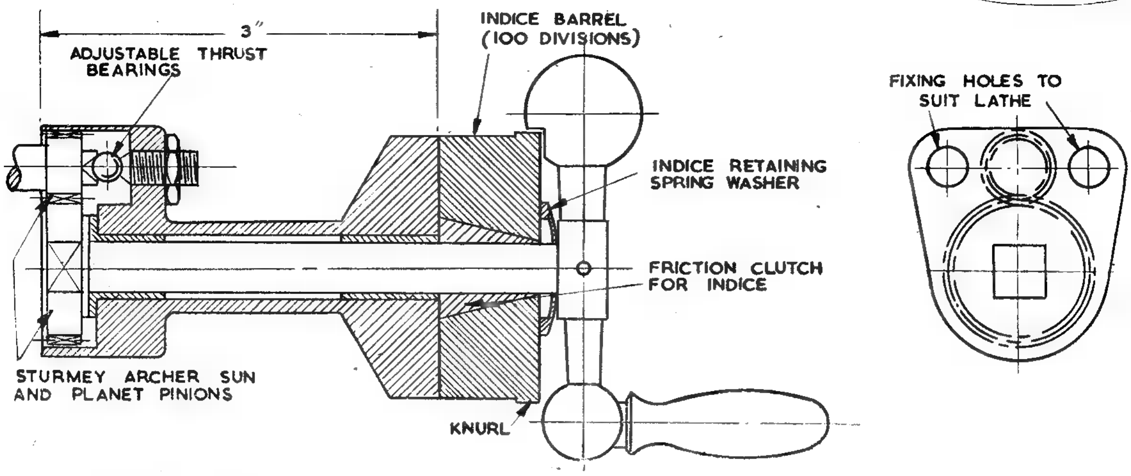
Having decided on a larger diameter arbor, the question of boring the pulley arose. My lathe only had a two-step cone pulley for flat belt, and on examination of the pulley and its back gear pinion, I decided to make a new pulley and pinion. The new pulley was to be a four-step to use " A " sect V belt, the old pulley had its pinion attached with two dowels. The new pinion was only about 5/32 in. thick from tooth-root to bore, so it was made in the form of a tube with the pinion teeth standing proud, the inch or so next to the pinion being left 0.010 in. larger than the root diameter of the pinion and the cutter run across it when the teeth were cut. The pulley was bored root diameter and the pinion forced in under a hand press.

The bearing shells were turned up + 1.020 in. on the o.d. scraped to suit the journals and mounted on the arbor with a tubular spacer, and turned to size between centres to ensure truth of the journal bearing shells when inserted in their housings.

To obtain the correct spacing of the bearing shells, the shells were placed in their housings and the arbor inserted (bone dry). The



General arrangement of modified arbor for a 4¼-in. lathe. Material—3-in. nickel-steel. Backplates screwed 2¾ in. diameter, 12 t.p.i.



Extension to feedscrew for $4\frac{1}{2}$-in. lathe. (To reverse direction of screw and give 2-1 step-up in feed)

front shell is then gently slid forward until both front and rear tapers bite. Then the gap between head and shell flange is checked, and a washer made to suit. To facilitate correct spacing, the flange to flange dimension of the shells should be made plus about a $\frac{1}{16}$ in., so as to give [redacted] washer that can be easily machined to size.

The adjustment of journal clearance is quite simple, the arbor minus thrust-races is inserted in the front shell (dry, no oil) and the gap between arbor and shell flanges, at which the shell will just move noted. The inclusive taper of 6 deg. is roughly equal to a taper of 1 in 10, so as to give a journal clearance of 0.0005, 0.005 would have to be added to gap already noted, this is the overall thickness of the front thrust washer or race.

The method of retaining the chucks is straightforward and needs no explanation. To remove chucks, the retaining nut is unscrewed about half a turn, it then engages against the rear washer of the thrust-race, further turns of the nut will force the backplate off of the nose taper. The original design allowed for two driving pins in the rear of the backplates to engage in clearance holes in the arbor flange. However, the holes could not be put in until the plates had been faced off on the new arbor, and whilst facing off the plates, cuts of $\frac{1}{8}$ in. depth were taken at 3 in. radius without any slip, and the nut only moderately tight, so I haven't bothered to fit the driving pins.

The beauty of this method of chuck location and affixing is that the chucks are the equivalent of [redacted] drive fit on the arbor and yet come off easily due to the fine pitch of the retaining-nut thread.

The other modification was to the cross-slide feedscrew. When screwcutting with the top-slide set round to half the thread angle, the handles of the top- and cross-slides used quite often to foul each other, and the cross-slide handle would often foul the base of the top-slide. So an extension was decided on, also an index. For convenience in replacing feedscrew nuts, my cross-slide nut is tapped $\frac{3}{8}$-in. B.S.F. ($\frac{3}{8}$ in. 20 t.p.i.), giving 0.050 in. advance per turn; also, it goes the "wrong way" (being right-hand the feedscrew turns opposite to the general run of lathes), so a gear train to step up the revolutions of the feedscrew, and to reverse its direction was decided on.

In my possession at this time were a sun and planet pinion from [redacted] Sturmey Archer 4-speed cycle gear, of 30 and 15 teeth respectively. The planet pinion was driven on to the end of the modified feedscrew, and ball thrust-bearing fitted. The sun pinion was driven on to the end of the new handle shaft. The backlash of this arrangement is about 0.002, which is imperceptible on the index.

The dropping of the handle shaft enabled me to use an index 2 in. in diameter with clearly marked divisions. The taper friction clutch that holds the index dial is most effective and very useful when screwing.

HOW TO GRIND SMALL TOOLS

(*Continued from page* 435)

be raised or lowered to accommodate tools of various sizes. The vertical arm is pivoted on the small angle bracket secured to the baseboard and, at the upper end of the same arm, the spindle of the grinding rest is carried in [redacted] rotatable clamp which is fitted with a thimble for locking the rest in place.

For convenience of storing, the supply wiring has [redacted] detachable connector fitted close to the motor. When the control lever is moved to the right, the circuit is broken, and on the first stud the whole of the wire resistance is put in series with the armature windings; on moving the lever on to the second stud, the resistance is cut out and the full current is supplied to the motor. For safety in handling, the switch connections are covered with [redacted] sheet of plastic insulating material.

When the grinder was built, the intention was to make [redacted] miniature twist drill grinding jig for mounting on the baseboard, for at that time drills smaller than No. 60 were often used. However, this was never done, [redacted] these small drills are now so seldom wanted, and those of size No. 60 and upwards can be correctly ground in the larger machine described [redacted] short time ago in this journal.

Nevertheless, this would be [redacted] rather fascinating job; the drills would be supported, centred, and indexed by [redacted] of the fitting described for holding small drills, and there would be little need of providing for [redacted] varying amount of back-off in these very small sizes. It would, however, be most important to arrange for precise end-location of the wheel spindle.

A DRILLING ATTACHMENT for the lathe

By S. E. Capps

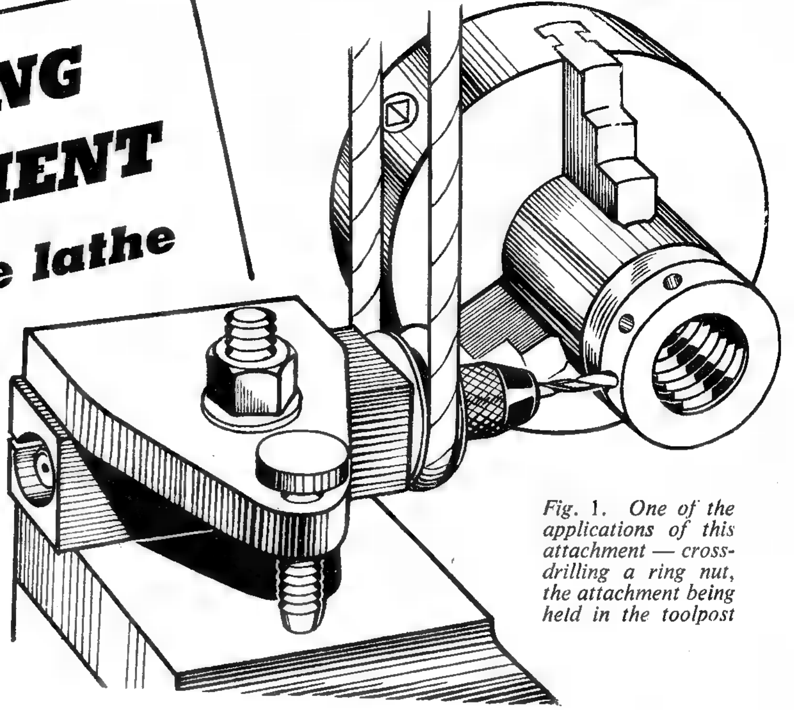


Fig. 1. One of the applications of this attachment — cross-drilling a ring nut, the attachment being held in the toolpost

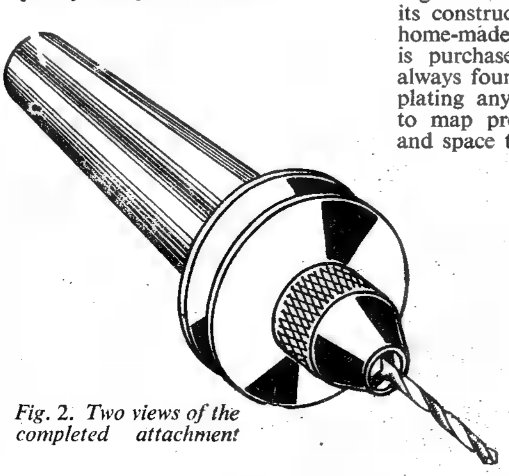
MANY small lathe users will have found that when drilling very small holes from the tailstock, the highest spindle speed is not always high enough, with the result that small drills cut slowly, and unless the greatest care is used in manipulating the tailstock pressure, broken drills are numerous. It became obvious to the writer that drilling holes of $\frac{1}{16}$ in. and under on a lathe of 3 in. centres was not easy or quick, but expensive in drills and time.

One remedy was to increase the spindle speed, or drive the drill separately at its right number of revolutions. If the former method was adopted, then the general turning speeds would be too fast. This could be overcome by a countershaft giving the high drilling speeds necessary for these small drills and the right turning speeds as well, but such a countershaft would be costly to install, and might quite possibly be troublesome.

In any case, there is no point in driving a lathe spindle at an excessive speed suitable for these small drills, thereby subjecting it and its bearings to undue wear, if the matter can be arranged another way. Therefore, I decided to build a tailstock drilling attachment, to be driven from the overhead pulley, as this seemed the easiest solution.

The overhead pulley existed, and a suitable attachment to drive the drills was all that was needed. The accompanying sketches show the attachment that was made. Fig. 2 shows the complete attachment, and Fig. 3 the assembly of parts used in its construction. All the parts are home-made except the chuck, which is purchased ready-made. I have always found it best, when contemplating any attachment for a lathe, to map precisely in measurements and space that part of the machine where the intended attachment is to go. In this case it is the tailstock, and such a fitment as this could be operated from the tailstock ram without being affected by the saddle toolpost. Having ascertained this, the design can be drawn out and the parts made accordingly.

The taper sleeve shown in Fig. 4 was made first from a piece of annealed cast-steel. This was chucked and turned taper to fit the bore in the tailstock ram, and its centre drilled right through. It was then put on a mandrel, and the ends turned out for the steel balls. Cutting both end races on a mandrel ensures their being true with each other. Polish the races dead smooth, with a mirror-like finish. The counterbore in the large end is, of course, done when the centre hole is bored, and is only an enlargement of this end of the bore to accommodate



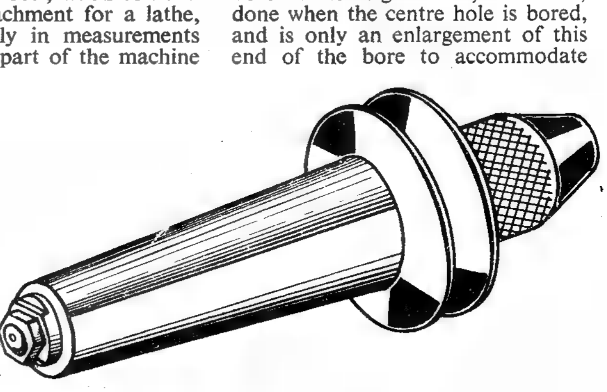


Fig. 2. Two views of the completed attachment

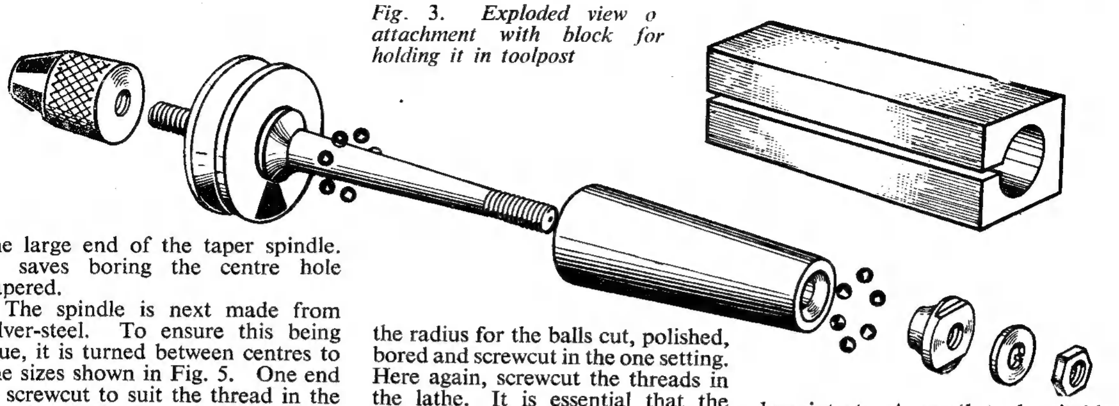


Fig. 3. Exploded view o attachment with block for holding it in toolpost

the large end of the taper spindle. It saves boring the centre hole tapered.

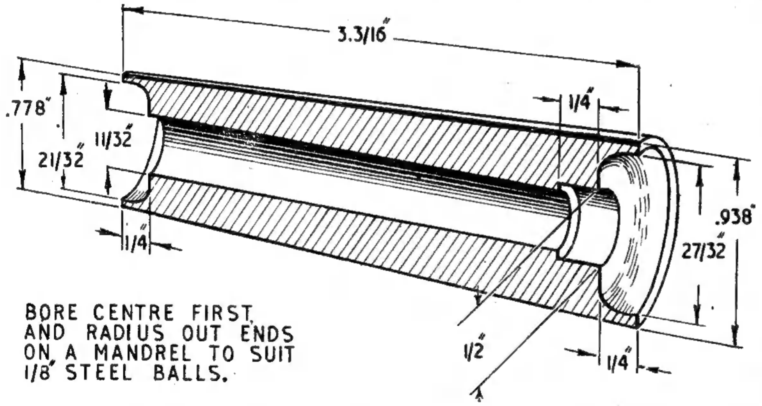
The spindle is next made from silver-steel. To ensure this being true, it is turned between centres to the sizes shown in Fig. 5. One end is screwcut to suit the thread in the purchased chuck, and as these vary with regard to the size and number of t.p.i., no details of this are marked on the sketch. Note that this thread must be long enough to take the cone, and pulley, and also allow sufficient length to operate the chuck. The method of assembly of cone and pulley used may not appeal to those who favour keys and keyways, but it is quick and efficient. With the cone tight against the shoulder on the spindle, and the pulley tightened hard against this, together with the pulley locked by a grub-screw into the spindle, there is very little chance of trouble by it working loose, even when using the largest drill the chuck will take. The other end of the spindle is screwed to take the rear cone locking washer and nut. Note that both threads are cut in the lathe. I do not advocate using dies, as this must be a precision job. The small keyway to take the locking washer can be cut in the lathe, with a small parting tool used on its side.

These also are made from cast-steel, as this is easiest for hardening. Figs. 6 and 7 give details of both. They can be turned to shape, and the radius for the balls cut, polished, bored and screwcut in the one setting. Here again, screwcut the threads in the lathe. It is essential that the thread should be dead true with the race itself, in order to enable accurate adjustment of the cones to be obtained. If one cone is only slightly out, the spindle cannot be expected to run dead true, and it is imperative that it should, when using very small drills.

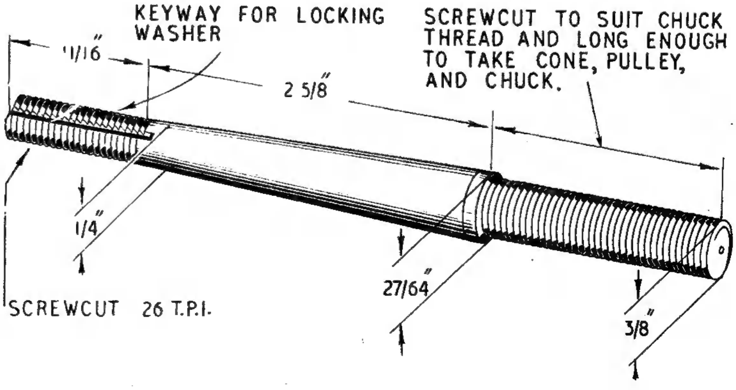
Make the nut and washer also in the lathe. The washer, obviously, will have to be drilled smaller than the thread, and enlarged afterwards with a file, or shaped out in the lathe, leaving the part to act as a key intact. A small tool suitably ground and held in the toolpost will do this job without much trouble, and results in a better job.

The pulley is made from a piece of mild-steel, and as Fig. 8 shows, can be turned, screwcut and polished in the one setting. Here again it is essential that it should run dead true, so cut the belt groove first, as this incurs the heaviest turning. It is doubtful if the average home-worker uses a lathe robust enough to allow this job to be finally parted off from a block held in the chuck, so turn and screwcut it and make a note of this particular face, then cut it off by what means you have, then face it off. This side will face the drill chuck when the pulley is assembled on the spindle.

The sleeve and cones are next, hardened, and as these are cast-steel, water hardening will do. Heat the sleeve to a bright red in a flame, and quench vertically in clean cold water. I use mains water, as this is free from impurities



Left: Fig. 4. Tailstock sleeve, No. 3 Morse taper—cast-steel, hardened and tempered



Below: Fig. 5. The spindle—silver-steel, turned between centres

that sometimes exist in water from a storage tank, and because it is usually much colder. Take care in heating not to go above a bright red, or scaling of the metal surface will result, destroying the high finish. When hard, clean up bright, and temper the sleeve from the centre. Play the heat here until the centre is blue and the end races turn a light straw colour. The cones are hardened in the same way, and tempered to a slightly darker straw colour. This will make them a little softer than the races. I have had too hard cones crack and break when being tightened up against a shoulder, or by the compression of a nut, and find it is better to renew a cone through wear than run the risk of one breaking when in use.

The parts are now ready for assembling. Grease well the end races in the sleeve, and screw the front cone on to the spindle. Screw this up as tight as possible against the shoulder, and screw on the pulley up against it. Make sure the front face of the pulley, that is the side that was faced off when the thread was cut, is next to the cone. Screw both up as carefully as possible. If you use wrenches, see that you don't apply excessive force. It is possible to distort the spindle if it is overdone.

When the pulley is tight, drill and fit a grub-screw or pin through the centre, and into the shaft a short way. It is not necessary to drill right through the spindle, but this is optional. If drills of the full capacity of the chuck are to be used, then fix the pulley, but if the limit will be 3/32 in. then the tightening alone will be sufficient. Stick the steel balls into the greased front race, and thread the spindle through the sleeve. Now insert the balls at the rear end, and screw on the cone, followed by the locking washer and the nut. Adjust this cone very carefully until no play is felt, and the spindle runs freely. Lock the cone in this position, using one spanner on the cone flats and another on the nut.

The attachment is now ready for use, assuming an overhead drive or other means of driving it is available. Fig. 9 shows it set up in the tailstock, where it performed very efficiently the purpose for which it was constructed, and I have had no further broken drills or wasted time from this source.

After use in the tailstock for some while, it appeared that its usefulness would be increased if it could be operated from the toolpost. Accordingly, the square holder shown in Fig. 3 was made, to hold the tapered sleeve under the toolpost clamp. Fixed here, it was at once seen that the scope of the attachment was greatly increased. Figs. 1 and 10 show two applications, one where a ring nut is being cross-drilled for tightening holes, and the other a cylinder end being drilled for its end plates. Both of these jobs were done in conjunction with a division plate on the lathe spindle. The time normally required for such

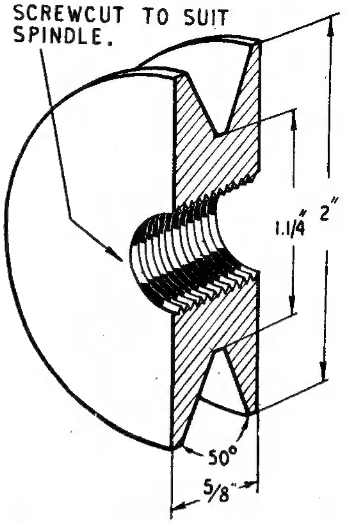


Fig. 8. Driving pulley—mild-steel. All turning operations in the one setting

jobs is considerably reduced as dividing, marking-out and drilling by hand or drilling machine is avoided. In a few months it was surprising the number of jobs usually requiring several operations to complete that were made entirely in the lathe. Many others were carried much nearer completion before removal from the lathe.

Fig. 11 shows some of the applications of the attachment to various jobs, and it will be obvious that it has many advantages over the more

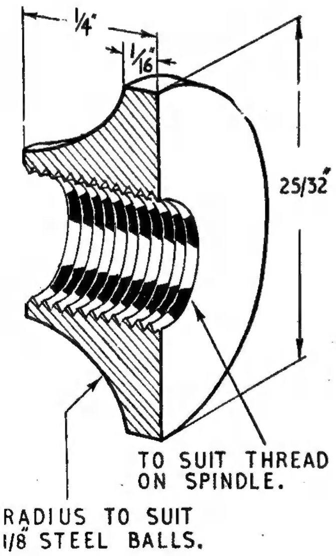


Fig. 6. The front cone—cast-steel, hardened and tempered. Cone, thread and radius are turned in one setting

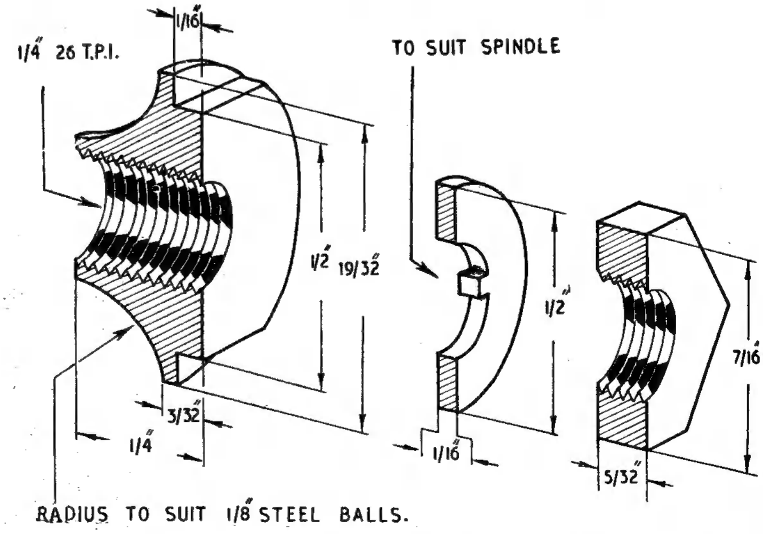


Fig. 7. Rear cone, washer and nut. Cone—Cast-steel, hardened and tempered. Nut and washer—Mild-steel

Fig. 9. The attachment fitted to the tailstock

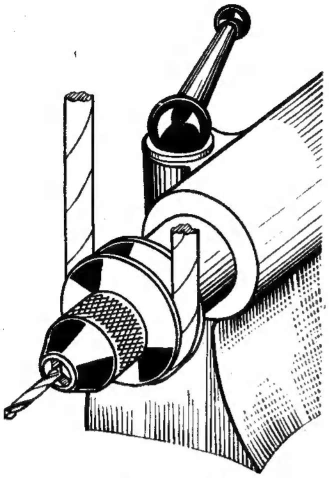
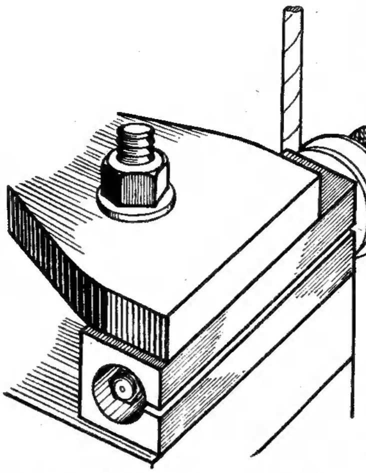
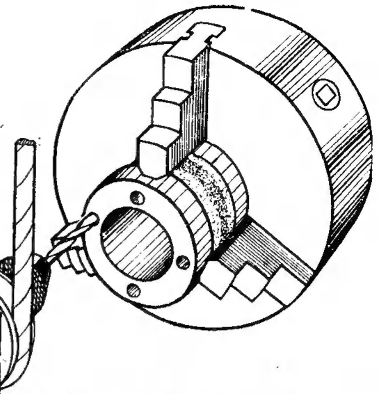


Fig. 10. Another application—drilling fixing holes in a cylinder end





common ways of doing these and similar jobs. *A* is a small flange which is turned, screwcut, partly cut off, then drilled for its fixing holes, and finally parted off finished. *B* is a flat round disc which is to have a square hole and be used as a washer. This was turned to size and thickness, partly cut off, then the lines of holes to form the square drilled as shown, using the cross-slide to position the holes. It is then finally parted off, and finished in the vice. Many of us know the amount of drill grabbing that such a job can cause when drilled by hand or under a drilling machine. *C* is part of a coupling. It is obvious that a job like this can be troublesome under a drilling machine, and still more so if done by hand. Here it is rigidly held in the chuck, while such holes as are necessary can be obtained with the aid of the attachment.

The job shown at *D* is easily carried out by dividing and drilling with the attachment. It is a conical-shaped spray cap, which is first turned to shape, internally and externally, screwcut internally, reversed in the chuck, and the spray holes divided and drilled without trouble. Such a job can be very difficult drilled by hand methods.

The front bearing plate and the end of a small electric motor casing are shown at *E* and *F*. The plate is set up in the independent chuck, turned, the register formed, and the centre hole bored. The brush holes and corner fixing holes are drilled by the attachment. The motor casing is mounted, its tunnel bored to fit the register, and the corner fixing holes drilled in the same setting. Dividing by the division plate ensures the fixing holes agreeing with each other, and avoids the necessity of drawing one or more holes over with a round file, as often happens with such a job when done by separate operations by hand. *G* is the disc commutator for the motor.

Another job that can be troublesome under a drilling machine, and still worse when drilled by hand, is shown at *H*. Fortunately this is only an occasional job, but I have found it quicker to drill the shank in the lathe, as shown, as control of both boring bar and drill is more rigid, and consequently there is less risk of broken drills.

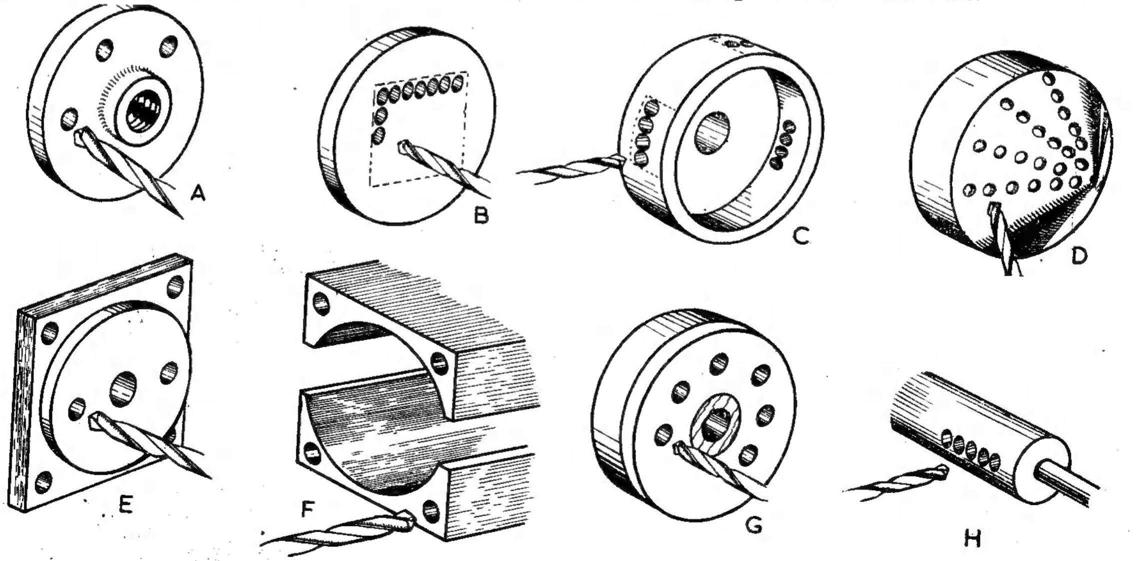


Fig. 11. Further applications of the attachment. These are dealt with in the article

READERS' LETTERS

● **Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

AN ELECTROMAGNETIC CLUTCH

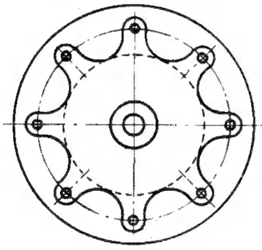
DEAR SIR,—I was very interested in the articles by Mr. R. F. Stock describing the electromagnetic clutch which he has constructed. It so happens that some time ago I had to design a similar clutch and although the application is different, a comparison of results may be of interest.

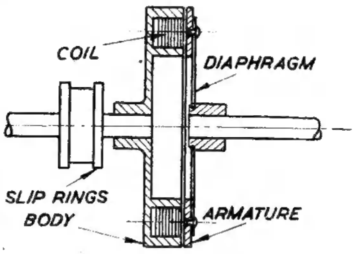
The enclosed graph of torque against ampere-turns shows the results obtained using mild-steel for the construction. It is worth noting that Mr. Stock's figure of 35.25 A.T. producing a torque value of 8 lb. in. is confirmed by my results.

The only significant difference between the two designs is in the method of allowing for armature movement. As may be seen from the reproduced sketch, herewith, I attached the armature to its shaft by a diaphragm of 0.01 in. thick benyllium copper. This method was necessary because the shafts are carried in ball-bearings and no back-lash, such as would have been inevitable had keys or splines been used, was permissible in the system.

If properly constructed, the spring of the diaphragm withdraws the armature when the magnetising current is switched off, and no other spring loading is required.

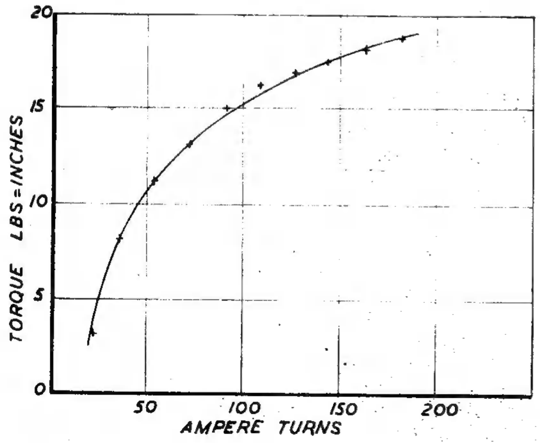
It will be seen that the magnetic circuit is less efficient in my design than in that of Mr. Stock's; this is because low inertia was of more importance for my application than low operating current.





Finally, may I congratulate Mr. Stock on his articles, they were a pleasure to read.

Yours faithfully,
Portsmouth. R. V. BRASS.



KEY CUTTING

DEAR SIR,—I was greatly surprised at the sentiments expressed in the letter from P. Keller where he, in other words, suggests that the cobbler should stick to his last (THE MODEL ENGINEER issue for Sept. 17th, 1953). He says that the reader should take his locks and keys to an ironmonger, who would cut new keys on a proper machine; now isn't it lucky for P. Keller that somebody, who quite likely, was *not* an ironmonger, had the intelligence, and, more important, the interest, to design a "proper machine" for key cutting. Were P. Keller's suggestion carried to its logical conclusion, there would be no "M.E." Cameras, Microscopes, Clocks, no "L.B.S.C." locomotives; in fact, there would be no model engineers at all, for everything would be bought ready made. His letter leads one to think that P. Keller, who is now only an assistant, hopes one day to be a full-blown ironmonger, and writes with the objective of protecting his trade, I don't think he need fear any loss of business as long as we model engineers require tools. Very few of us are model engineers for the purpose of saving money; in fact, it is very often cheaper to buy a ready-made article because of mass production methods; but does it not give one more satisfaction to carry out a job without outside help?

Personally, I found Mr. E. Capp's article interesting, as also were the letters following. I found, however, that I could not let Mr. P. Keller's letter pass, as I do not think he is imbued with the true spirit of model engineering and his policy would tend to defeat the whole purpose of our journal, so often defined by the late Percival Marshall.

Yours fraternally,
Liverpool. WM. CLEGHORN.

FAULTY FIGURES

DEAR SIR,—With regard to the article No. 20 in the September 3rd issue by W. J. Hughes, and his scale quotations, I would point out that his maths. are a bit "out." I quote: "For example, 7/12 in. in 1 in. scale equals $\frac{7}{8}$ in. in $1\frac{1}{2}$ in. scale, and both equal 7 in. in full size."

Using the foot (12 in.) as a basic size, if you use two different scales, i.e., 1/12 and $\frac{1}{8}$ in., you are bound to get different results. Therefore, 7/12 of 1 foot in 1/12 scale = 7 in., $\frac{7}{8}$ of 1 foot in $\frac{1}{8}$ scale equals $10\frac{1}{2}$ in. When I say $\frac{1}{8}$th scale I mean $1\frac{1}{2}$ in. = 1 ft., naturally.

Whilst writing I'd like to call up the Chichester Society of Model Engineers, thanking them for publishing the Longmoor Public Day date. Needless to say, I had a very happy weekend meeting old friends, as I am an ex-sapper.

Yours faithfully,
Luton. R. MAC[illegible].